DRAFT
ENVIRONMENTAL ASSESSMENT

South Branch of the Rahway River
Emergency Streambank Stabilization (Section 14)
Town of Woodbridge, Middlesex County, New Jersey

October 2005

U.S. Army Corps of Engineers
New York District

New Jersey Turnpike Authority
Garden State Parkway Division

FINDING OF NO SIGNIFICANT IMPACT

The US Army Corps of Engineers (USACE), New York District, in coordination with the New Jersey Turnpike Authority (NJTA), proposes to stabilize 1,625 feet of the streambank along four separate reaches of the South Branch of the Rahway River (South Branch), in the Town of Woodbridge, Middlesex County, New Jersey. The study was authorized under Section 14 of the Flood Control Act of 1946, as amended, to study and construct emergency streambank stabilization measures for public works and non-profit public services. Federal interest was identified for implementation at this site to protect the Garden State Parkway (Parkway) and its entrance and exit ramps, Gills Lane, and Menlo Park Terrace School property.

The project area includes four reaches of the South Branch and its tributaries from milepost 130.5 to 132.2 of the Parkway. Existing banks were damaged during Hurricane Floyd in 1999, beginning the erosion and scour that now threatens public infrastructure. Compounding the existing problems are two unused structures within the stream corridor that act as hardpoints creating unnatural banks and bottom habitat that causes eddying and further erosion of the banks during storm events. The existing streambanks include heights up to 12 feet high with nearly vertical, bare soil slopes.

Project alternatives that were considered included:

- Alternative 1: No Federal Action Alternative;
- Alternative 2: Bank Stabilization with Gabion Baskets;
- Alternative 3: Bank Stabilization with Riprap;
- Alternative 4: Bank Stabilization with Willow Stakes
- Alternative 5: Bank Stabilization with Willow Stakes and a Stone Toe;
- Alternative 6: Bank stabilization with Vegetated Gabion Baskets;
- Alternative 7: Bank Stabilization with Vegetated Crib Walls.

Alternative No. 6 - Bank stabilization with Vegetated Gabion Baskets, is identified as the preferred alternative. Bank height and slope, as well as stream velocities and proximity of structures (including buildings, roads, and cemetery plots) to the top-of-bank, determined the need for hard structures. This alternative will stabilize the banks without requiring extensive regrading and loss of the existing riparian habitat. Vegetating the gabion baskets will also help to lower the environmental impacts by providing habitat functions to the riparian corridor and shading the stream system. The vegetation will also improve the aesthetics of the structures, an important consideration in these urbanized areas.

No significant impacts to the environment are anticipated. My determination of a Finding of No Significant Impact is based on the Environmental Assessment and the following considerations:

- The project is located within the floodplain of the South Branch and borders on a few small wetlands, but I find that all reasonable alternatives were considered in the evaluation of this water-dependent project and that no

impacts to wetlands are expected. I, therefore, find this project complies with the meaning of Executive Orders 11988 and 11990.

- Construction will result in localized, short-term increases in the suspended solid load in the South Branch of the Rahway River. Sediment loading will be minimized by employing standard erosion control techniques and is not expected to exceed that which is seen during storm events.

- Although temporary impacts to the fish community may occur during construction, the stabilization of the banks will decrease the long-term sediment loads to the stream and the vegetation will also provide nutrient inputs and shading to the system.

- This project will have no adverse effects on known historical and archaeological resources.

Based on my review and evaluation of the environmental effects as presented in the Environmental Assessment, I have determined that the South Branch Section 14 Emergency Streambank Stabilization Project is not a major federal action significantly affecting the quality of the human environment. Therefore, I have determined that this project is exempt from the requirement to prepare an Environmental Impact Statement.

_____ _____

Date

Richard J. Polo, Jr.
Colonel, U.S. Army
District Engineer

Environmental Assessment for the
South Branch of the Rahway River Emergency Streambank Stabilization Project
Woodbridge, Middlesex County, New Jersey

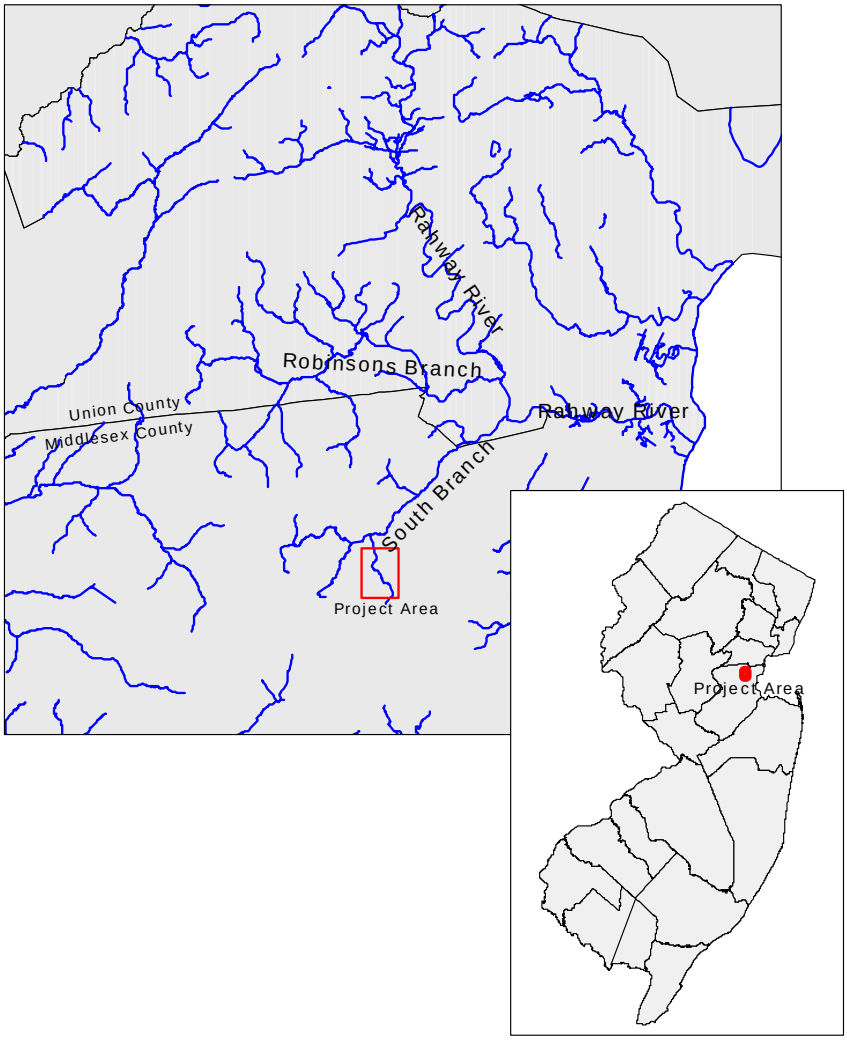
TABLE OF CONTENTS

1.0 INTRODUCTION

At the request of the New Jersey Turnpike Authority (NJTA), the U.S. Army Corps of Engineers (USACE), New York District, has conducted a feasibility study of emergency streambank stabilization alternatives for an area along the South Branch of the Rahway River (also known as the Parkway Branch) and its tributaries in the Town of Woodbridge, Middlesex County, New Jersey (Figure 1). The study was authorized under Section 14 of the Flood Control Act of 1946, as amended, to study and construct emergency streambank erosion protection measures for public works and non-profit public services. Federal interest was identified for implementation of corrective measures to protect the Garden State Parkway, its entrance and exit ramps, Gills Lane, and a school parking lot within the project area.

The study area is located along the South Branch of the Rahway River and its tributaries from milepost 130.5 to 132.2 of the Garden State Parkway (Parkway). The proposed

Figure 1: Site Locator Map



project will include four reaches of the streams within this area that total approximately 3,050 linear feet of stream (Figure 2). The parcels in Reach 1 are either owned by the Beth Israel Cemetery or are within the right of way of the highway. Reach 2 is completely within the property of the Menlo Park Terrace School and is owned by the Woodbridge Township Board of Education. Reach 3 includes portions owned by the Mount Lebanon Cemetery and the County of Middlesex. Reach 4 includes land owned by private citizens and by the Star Realty Group.

Figure 2: Project location

The streambanks of the study area are eroding to the extent that further recession would compromise the structural integrity of the Parkway, its access ramps, Gills Lane, and a public school parking area. The current erosion is believed to have been due to an obstructed culvert during Hurricane Floyd in 1999 (John Withers, principal engineer NJTA, personal communication). The culvert was blocked by debris that created flooding and eddying and caused the initial intense erosion of the banks. Without

stabilization, the erosion is expected to continue with subsequent storm events. Compounding the current problem are two unused structures that are being considered for removal. One structure is an unused low-water road that crosses the streambed near the Menlo Park Terrace School (Reach 2). The access road is a concrete structure that causes eddying and misdirected flows into the banks downstream and creates an area of unnatural bottom habitat. Its removal would allow for a more natural flow as well as a more natural bed structure. The second structure, located in Reach 3, is an abandoned double culvert bridge that is no longer connected to a road system and is no longer aligned with the stream. The stream is now forced to flow at unnatural angles around the structure, using the culverts only during high water flows. This is causing erosion to the west bank and removal would allow for a less obstructed, more natural flow.

2.0 STUDY PURPOSE AND NEED

The purpose of the proposed project is to provide long-term streambank stabilization and protection to public utilities within the project area.

The 173-mile Garden State Parkway runs north and south, through 50 municipalities in 10 counties, from the New York line at Montvale to the Cape May Ferry in Cape May. The highway was completed in 1955 and by 2001 over 408,800,000 vehicles have utilized the road. The amount of traffic on the highway increases every year, with an increase of 2.7% between 2000 and 2001 (NJTA 2004).

Four reaches of the South Branch and its tributaries are eroding and could cause damage to the Parkway and other public infrastructure. Erosion in Reach 1 threatens the Parkway, as well as the entrance ramp from U.S. Route 1, and U.S. Route 1 itself. Reach 2 includes erosion that threatens the Menlo Park Terrace School and its associated parking lot. Reach 3 erosion threatens Gills Lane, which is an access road to Route 1 and the Garden State Parkway. Erosion at Reach 4 threatens the access ramp to the northbound lanes of the Garden State Parkway from Route 27 (the Lincoln Highway). Erosion has also exposed two municipal sewage lines in this reach and has eroded the bed of the stream to bedrock throughout most of this reach.

The project area is between mileposts 130.5 and 132.2 of the Parkway in Woodbridge Township. Due to the extensive urbanization and amount of impermeable surface in the watersheds (Figure 2), large volumes of water race through the small tributaries during storms. These high velocity flows have caused severe erosion along the outer banks and bottoms of these streams. As a result, pipelines have been exposed and the Parkway and entrance ramps have been threatened.

3.0 PLAN FORMULATION AND SELECTION

The intent of the South Branch of the Rahway River Emergency Streambank Stabilization Study is to analyze a variety of alternatives, select an optimal plan to protect the Garden State Parkway and other public infrastructure, and make a recommendation for implementation. The optimal plan is the alternative with the greatest net benefits

based on evaluation of potential environmental impacts, feasibility of the approach, and comprehensiveness of the solution. In order to arrive at the optimal plan, alternatives are screened based on[BJM1] environmental, engineering and social considerations. The identification of potential mitigation measures is also conducted in concurrence with plan formulation.

The following is a summary of the alternatives that were considered in the plan formulation process. These alternatives were evaluated and screened to arrive at the optimal plan, referred to as the recommended plan, as described in section 3.3.

3.1 Alternative Identification

As this is an emergency situation, the placement of stabilization needs was set by the site conditions. Therefore alternate site selection was not considered. Also, moving the Garden State Parkway or the other infrastructure was considered to be beyond the scope of this project. As such the alternatives considered included a variety of materials and methodologies to stabilize the banks. The following alternatives were identified for initial consideration:

Alternative 1: No Federal Action Alternative - No further action would be taken by the federal government.

Alternative 2: Bank Stabilization with Gabion Baskets – Stone-filled gabion baskets would be constructed from the toe to top-of-bank.

Alternative 3: Bank Stabilization with Riprap – Riprap rock would be placed along the banks from the toe to top-of-bank.

Alternative 4: Bank Stabilization with Willow Stakes – Live willow stakes would be planted into the streambanks along the reach from the mean high water level to top-of-bank.

Alternative 5: Bank Stabilization with Willow Stakes and a Stone Toe – Live willow stakes would be planted into the bank above the mean high water mark while the lower, higher velocity toe of the bank is fortified with native rock.

Alternative 6: Bank stabilization with Vegetated Gabion Baskets – Stone-filled gabion baskets would be constructed from toe to top-of-bank with live whips and/or fascines placed between the baskets.

Alternative 7: Bank Stabilization with Vegetated Crib Walls – A vegetated crib wall consists of stacked logs filled with dirt into which native vegetation can be planted.

Alternative 8: Bank Stabilization with Vegetated Geogrid Walls – A vegetated geogrid wall stabilizes the bank using steel wire mesh filled with soil. Herbaceous and woody species are planted along the top and the face of the bank.

3.2 Project Alternatives Evaluated

3.2.1 Alternative 1: No Federal Action

The No Federal Action Alternative refers to the case in which the federal government would not take any action to repair, protect or relocate the endangered resources. With no intervention, it is expected that the streambank erosion would continue, compromising the integrity of the Garden State Parkway and other public infrastructure.

3.2.2 Alternative 2: Bank Stabilization with Gabion Baskets

This alternative consists of installing stone-filled gabion baskets along the streambanks. Gabion baskets are durable and long-lasting, can be installed without the use of heavy equipment (Freeman and Fischenich 2000), are adaptable to site specific conditions due to the flexibility in the size of the wire baskets, and they are easy to repair by refilling with stone or with the use of shotcrete (USACE 2002). They can withstand velocities of 14-19 feet per second (Fischenich 2001) and also aid in the reduction of storm water velocities by creating a rough surface and frictional drag for the storm water.

However, gabion baskets create an unnatural streambank that does not provide habitat for riparian wildlife. This loss of vegetation and shading can cause a temperature increase of the water as well as a lack of organic matter available to the stream. Gabion baskets also cause scouring in front of or adjacent to the structure due to wave reflection. This scouring can degrade aquatic habitat by increasing turbidity and can undercut and destabilize the structure (Freeman and Fischenich 2000). Also gabion baskets require periodic monitoring to identify wear or problems caused by debris that could cause structural failure.

3.2.3 Alternative 3: Bank Stabilization with Riprap

This alternative consists of placing rock along the bank. Appropriately sized riprap can withstand high velocities while producing minimal wave reflection, and thereby limiting the amount of scour. Riprap can be shaped to facilitate access to the stream for the public and for wildlife. The use of riprap requires a 1V:1.5H slope (USACE 1994). Existing bank slopes are up to 2V:1H, so that extensive regrading would be needed to achieve required slopes for this method. The existence of structures at the top of the bank, including buildings, houses, cemetery plots, roads and parking areas would preclude regrading in some areas.

Riprap, like gabion baskets, does not provide habitat for wildlife and creates an unnatural bank. The lack of shading and the stone can work together to increase the temperatures of the stream, causing stress to the aquatic habitat (MDEP 2004). Vegetation, including trees, can be allowed to grow through the riprap. The vegetation would shade the stone and the stream to lower the water temperatures, as well as provide habitat to wildlife (MDEP 2004).

3.2.4 Alternative 4: Bank Stabilization with Willow Stakes

Bioengineering is the integration of engineering principles and biological sciences to solve problems in ways that are more natural and ecologically sound. It often includes the use of live plant materials, utilizing the root systems to increase stability of the soil. Willow stakes are often utilized because they are hardy, native trees that can quickly grow from stakes to create a natural streambank. The advantages of using vegetation to stabilize streambanks include the creation of habitat along the streambank, creation of a canopy to help keep water temperatures low, and the vegetation can be more aesthetically pleasing to local residents when compared to traditional hard structures. The trees would also create a roughness along the bank that would help reduce local current and wave velocities (USACE 1997), while the leaves and stems also dissipate precipitation and slow sheet flow, thereby reducing erosion to the banks.

Willow stake plantings require a suitable environment. They require a fairly stable, gradual slope (1:1 or less) of suitable soils that receive adequate light for the plants to grow (USACE 1997). The velocity of the stream at the site must also be considered as willow stakes can only withstand velocities of approximately 0 to 8 feet per second (USACE 1989). Live plantings do require more initial maintenance, as some plants may be lost and would need to be replaced. Also, depending on weather, the plants may require watering to ensure initial establishment. As with the riprap, the extensive regrading needed for this alternative may be prohibited by the close proximity of structures at the top-of-bank.

3.2.5 Alternative 5: Bank Stabilization with Willow Stakes and a Stone Toe

Bioengineering often integrates traditional stabilization techniques with live plantings. The traditional structural methods are used in the most vulnerable sections and the biological plantings are used to stabilize the rest of the bank. The advantage is the use of a smaller amount of unnatural material that will often lower the cost and improve aesthetics, and would still allow for the improvement of habitat in the project area. In this case, a rock toe is utilized to stabilize the high velocity areas and willow plantings are used above for stabilizing the less vulnerable bank.

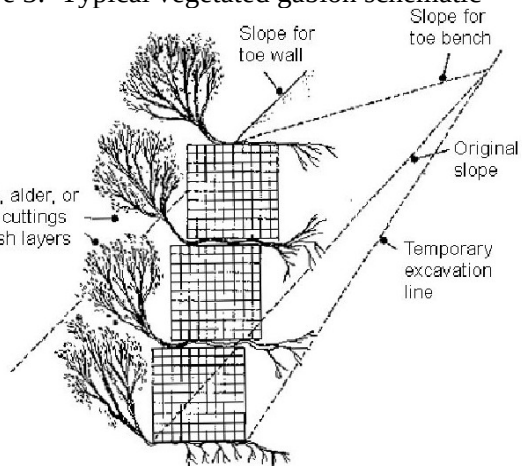
The habitat advantages of this combined alternative are similar to that of willow stakes alone. There is a slightly lowered benefit due to the need to use stone, which causes an unnatural toe of the bank. The stone can also cause scouring of the streambed (similar to the gabion baskets) however, the stone structure can be engineered to self correct, launching stone into the scour to protect from undercutting.

The plantings would require the same environment discussed above for proper growth, however the addition of the stone toe increases the velocity that the treatment can withstand (permissible velocity is dependent on the size and characteristics of the stone; Fischenich 2001). The slope characteristics still must be considered however, such that the willow stakes are planted on a stable gentle slope as discussed for willow stakes above in section 3.2.4. Again, the regrading needed for this method can be prohibitive in urban/suburban areas due to the proximity of structures.

3.2.6 Alternative 6: Bank stabilization with Vegetated Gabion Baskets

Gabion baskets can be used in conjunction with live vegetation. Live fascines or whips can be placed between the baskets with the end planted in the soil bank behind the gabions (Figure 3). The rooting of the plants will help to stabilize the gabion wall by anchoring into the bank, thus helping to prevent destabilization due to flanking of the gabions. The vegetation also improves the habitat characteristics and aesthetic value of the gabion wall. As described previously (section 3.2.4), live plantings do require more initial maintenance and monitoring to ensure growth of the plants. With this method however, the stability of the structure and of the erosion protection is not dependent on the growth of the plantings.

Figure 3: Typical vegetated gabion schematic



3.2.7 Alternative 7: Bank Stabilization with Vegetated Crib Walls

A vegetated crib wall is a box-like interlocking arrangement of untreated logs, which includes live stakes or plantings within and above the structure. The live vegetation would gradually take over the structural function of the wood as the plants become established. Vegetated crib walls can withstand high velocities (0-12 feet per second; Zone 7 2004) and can be used above and below the waterline where a stable streambed exists. Crib walls also provide habitat and maintain a natural streambank appearance.

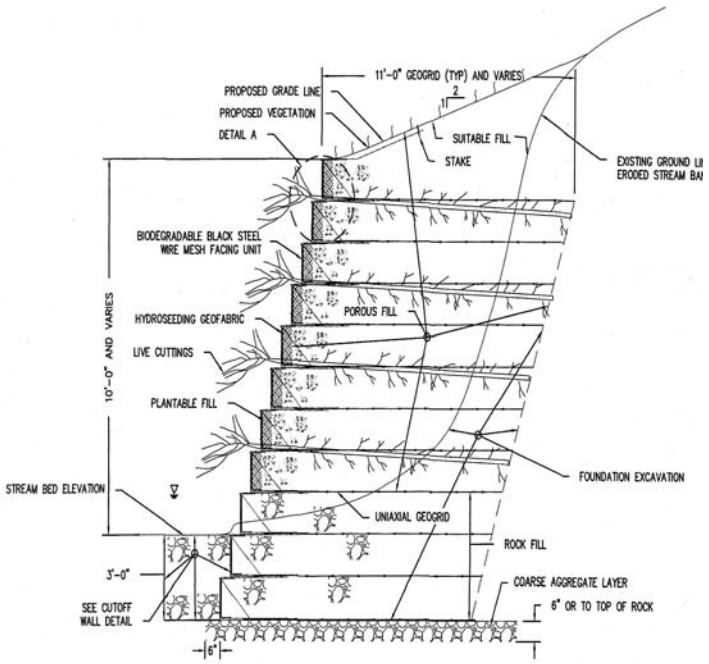
The use of vegetation, as discussed above, requires a greater commitment to monitoring. It is anticipated that a percentage of plants will not survive, and will therefore need to be replaced to ensure proper protection of the bank. The crib wall also requires keying into the bank, so it does require some excavation and distance from the structure to be protected. Cribwalls can be used for steep sloping banks, however, cribwalls are found to be unstable over 4 feet high. Therefore in areas where the banks are high enough to exceed the stability threshold of the crib wall, the top-of-bank would need to be regraded and stabilized with willow stakes or other plantings.

3.2.8 Alternative 8: Bank Stabilization with Vegetated Geogrid Walls

The vegetated geogrid wall under consideration includes layering structural materials with plantable fill so that plants are encouraged to grow (Figure 4). For this project the structural materials being proposed include three layers: a steel wire mesh face, followed by a plastic biaxial geogrid, and finally a hydroseeded geofabric. These layers are all included to add structural integrity to the bank while the plants have time to take hold and grow. The vegetation is then expected to take over the structural function of the materials and will stabilize the bank naturally.

These structures can be installed to create a steep slope that is very high. They have been installed successfully as retaining walls over 50 feet tall (Tensar Earth Technologies, Inc. 2002). This method creates a vegetated stabilized streambank that establishes habitat for riparian wildlife while shading the stream and maintaining the aquatic habitat.

Figure 4: Vegetated geogrid schematic



Installation of vegetated geogrid walls does include keying into the bank up to 11 feet, so excavation and heavy equipment is necessary. By excavating into the bank, many of the existing riparian corridor trees would be lost. This system is also dependent on plant growth for stability. Without plant growth, the system could be susceptible to storm damage by washing out the plantable fill.

3.3 Recommended Plan

Alternative 6, the use of vegetated gabion baskets, is the recommended alternative. This alternative would fulfill the project objectives at a reasonable cost with limited adverse effects to the environment. Velocities in the project area range from 2 to 13 feet per second (10 year design storm), bank heights are up to 14 feet, and slopes are up to 2V:1H. These characteristics, combined with the close proximity of various structures, require the use of hard structures, either gabions, geogrid wall, or vegetated gabions. To lessen the environmental impact of the project to the greatest extent possible, while not compromising the stability of the project, Alternative 6 was chosen as the main methodology for the stabilization work. At a few small specific areas other methods will be used, including riprap, concrete, and live willow stake plantings. In total, approximately 1,360 linear feet of vegetated gabions will be constructed, as well as 180 linear feet of live stakes, 85 linear feet of riprap, 30 feet of concrete headwall repairs to existing outfalls, and spot repairs to a concrete bag wall.

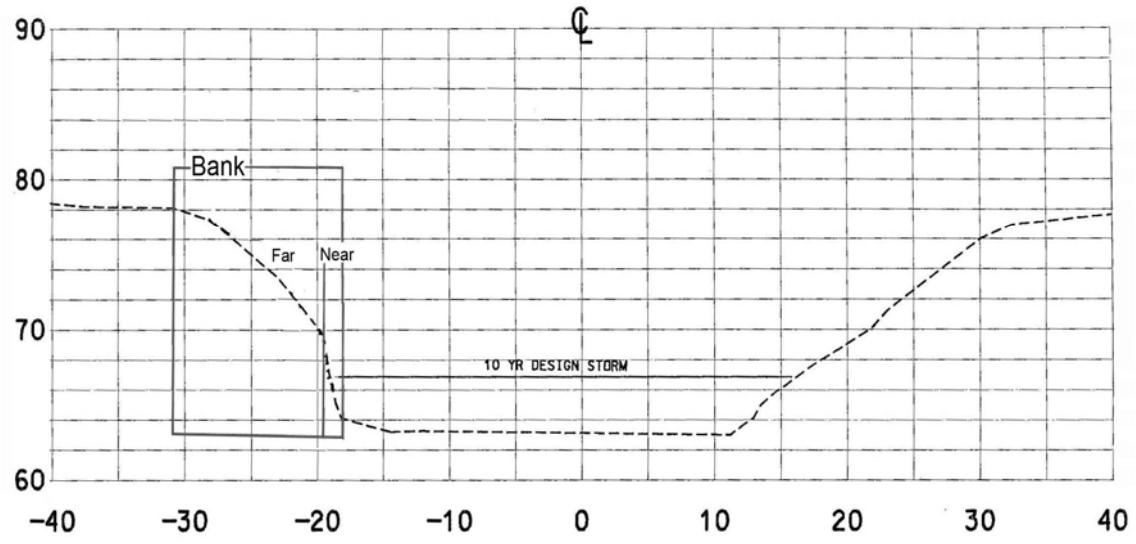
4.0 ENVIRONMENTAL SETTING

4.1 Overview

The project site is located in a suburban setting along the Garden State Parkway and other local roads (Figure 2). The typical cross section found in the project areas (Figure 5) includes a very steep near channel eroding bank of 4 to 10 feet in height, followed by a gentler sloping, often vegetated, far channel bank.

Reach 1 is approximately 1,350 feet long. Approximately 600 feet of vegetated gabion walls will be installed and riprap will be installed in two areas to total about 35 feet along the stream. There is also a small area, about 50 feet, that will be stabilized using the live willow stake method. The near channel banks range in height from 4-10 feet with slopes from 1V:1H to 3V:1H. The width of the stream ranges from 3 to 20 feet in this reach.

Figure 5: Typical cross section of the stream, with near and far channel bank denoted. Units are in feet.



Reach 2 is approximately 600 feet long. About 385 feet of vegetated gabion wall will be established within this reach with two areas of live willow stakes totaling approximately 130 feet. The near channel banks range in height from 3-8 feet with slopes of 1V:1H to 3V:1H. The stream is approximately 30 feet wide in this reach. A 15-foot wide low-water road exists at the upstream end of this reach and is proposed for removal. This reach also contains a failing bulkhead (approximately 12 feet long, 4 feet tall) made of a jumble of poured concrete, fencing, wood, and riprap.

Reach 3 is approximately 420 feet long, in which an estimated 300 feet of vegetated gabion wall will be constructed. The near channel banks range in height from 6-12 feet with slopes of 1.5V:1H to 3V:1H. The stream is 5-8 feet wide in this area. A 20-foot by 25-foot unused misaligned bridge exists near the downstream end of this reach that will be removed.

Reach 4 is approximately 680 feet long. This area will have approximately 75 feet of vegetated gabion walls installed, and an existing undermined concrete bag wall will be fortified. There is also a few outfalls that will be repaired with a concrete headwall and riprap, totaling approximately 50 feet. The east bank is almost completely fortified with a headwall, a concrete bag wall, or riprap throughout this reach. The western bank includes vegetated, gentle slopes of 1V:2H with heights up to 12 feet, but also includes

areas with a near channel bank that is 4 feet high and near vertical. The stream is 4 to 5 feet wide in this reach.

The water of the stream is fresh and the New Jersey Department of Environmental Protection (NJDEP) reports no confirmed anadromous fish runs in the Rahway River (thus no Essential Fish Habitat assessment is necessary). Any stabilization method used will not cause open water fill, so that any structure will be dug into the existing bank and the face of the post-construction bank will be similar to the pre-construction bank.

4.2 Landscape

The project site is located along the South Branch of the Rahway River and its tributaries in the Town of Woodbridge, Middlesex County, New Jersey. The stream runs along the Garden State Parkway. Streambank vegetation includes herbaceous and woody plants typical to the region, including Virginia creeper (*Parthenocissus quinquefolia*), poison ivy (*Toxicodendron radicans*), greenbrier (*Smilax* sp.), various oak species (*Quercus* spp.), American beech (*Fagus grandifolia*), Norway maple (*Acer platanoides*), red maple (*Acer rubrum*), and tree of heaven (*Ailanthus altissima*). Wetland species were also noted along the east bank at Reach 3, including skunk cabbage (*Symplocarpus foetidus*). Several introduced species are also present in the project area, including Japanese knotweed (*Polygonum cuspidatum*), bamboo (*Phyllostachys* sp.) and other cultivated garden plants.

Soils in the project area include the Boonton, Bucks, Rowland, and Haledon Series (NJDEP 2004). The Rowland soil type follows along the path of the stream, and all the other soils are upland series. The Rowland series consists of very deep, moderately well and somewhat poorly drained soils formed in alluvial sediments weathered from red and brown shale, sandstone, and conglomerate (USDA-NRCS 2004). Wooded areas with this soil type include mixed hardwoods. Rowland soils are formed on relatively narrow nearly level floodplains in alluvial sediments washed from nearby uplands (USDA-NRCS 2004). The Boonton series consists of deep or very deep moderately well and well-drained soils formed in till on uplands (USDA-NRCS 2004). Undeveloped areas with this soil include idle fields or forests with oaks, red maple, white ash, hickory, gray birch, and dogwood trees. Boonton soils are on gently sloping to very steep uplands. The Haledon series consists of very deep, somewhat poorly drained soils in low positions on undulating uplands (USDA-NRCS 2004). Vegetation on this soil includes forests dominated by oak and maple with some birch and ash. Haledon soils are at the base of steeper sloping uplands and in shallow drainageways. The Bucks series consists of deep well drained soil on uplands (USDA-NRCS 2004). Forests with this soil include mixed oaks, yellow-poplar, hickory and ash. Bucks soils are on upland divides and rolling slopes (USDA-NRCS 2004).

4.3 Water Resources

The South Branch of the Rahway River flows northeast to its confluence with the Rahway River. It is a part of the Rahway River/ Woodbridge Creek watershed (HUC 11 unit code 02030104050), in the Arthur Kill Watershed Management Area (NJDEP's Watershed Management Area 7). No public community water supply wells are located in

the South Branch sub-watershed (HUC 14 unit code 02030104050090; NJDEP 2004). The drainage area of the entire South Branch is 11.68 square miles. The area is a part of a sole source aquifer (meaning an aquifer that is the principle source of drinking water for a community) as designated by the USEPA (USEPA 2004).

The South Branch is classified as FW2-NT by NJDEP. The New Jersey Water Quality Standards identify their criteria both quantitatively and qualitatively. The standards for the higher quality "FW1" waters are qualitative, stating they "are to be maintained in their natural state of quality (set aside for posterity) and not subjected to any man-made wastewater discharges or increases in runoff from anthropogenic activities" (NJDEP 1998). However, the DEP does not give any details to describe this natural state. "FW2" waters have quantified limits for bacteria, pH, solids, oils, phosphorus, etc. that are based partly on toxicity and partly on ecological health. "FW2" is the general surface water classification for most surface water bodies in the state. Within the FW2 classification, a distinction is made between trout production and nontrout waters. The numeric criteria for this designation include limits for bacteria, metals, toxic substances, sediments, and some nutrients. The South Branch is designated as Non-Trout (NT).

The New Jersey Water Quality Standards also designate streams as Category One (C1) and Category Two (C2) waters. According to the water quality standards, "Category One waters shall be protected from any measurable changes to the existing water quality" (NJDEP 1998). Category Two waters are all waters not designated as C1 or as Outstanding National Resource Waters. The South Branch is designated as C2.

4.4 Wetlands

National Wetlands Inventory (NWI) maps show palustrine deciduous forested wetlands in Reaches 2 and 3 (Figure 6). In Reach 3 on the opposite bank of the river from the project area, skunk cabbage, which is an obligate hydropyhte, was found. In Reach 2, no wetland plants were observed. The steep banks that this project will be stabilizing do not contain wetlands.

4.5 Fisheries and Wildlife Habitat

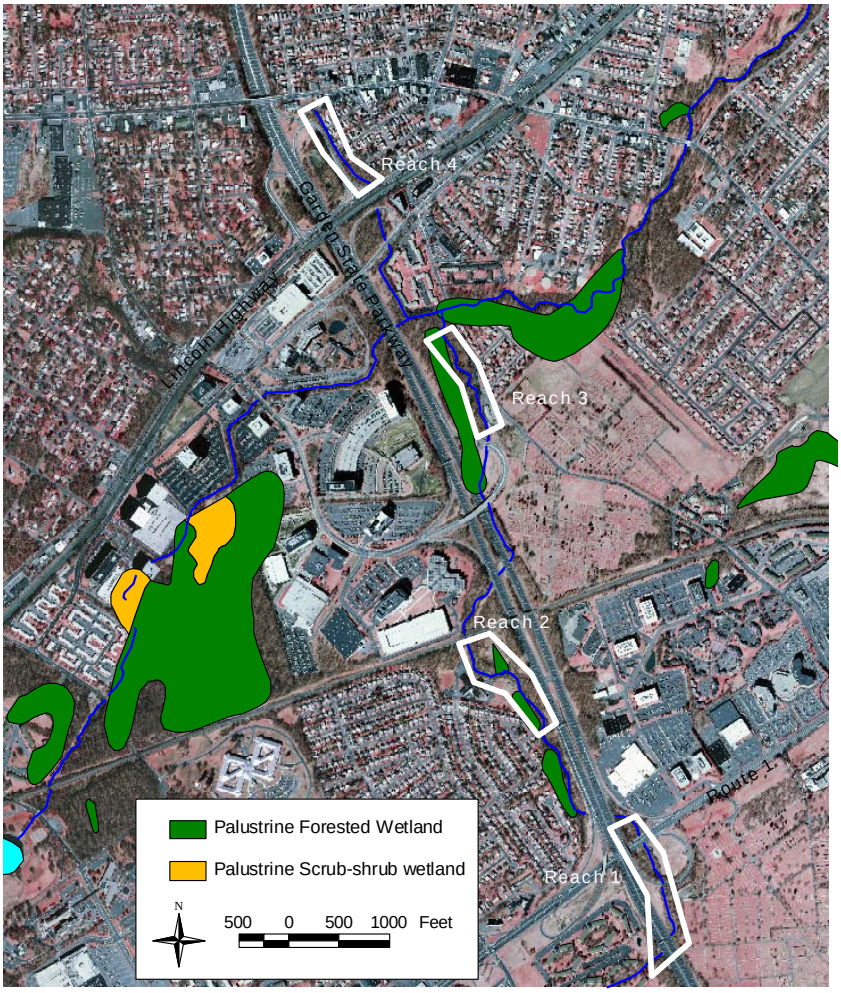
Included in Appendix A of this document is a copy of the Draft Fish and Wildlife Coordination Act Report (FWCAR) completed by the USFWS, New Jersey Field Office in June 2004 for the proposed project. Much of the following summary is adapted from that report.

The bottom substrate of the stream is predominantly cobble and gravel, however in Reach 4 the stream has eroded down to bedrock throughout most of the reach. The riparian corridor within the project area varies from 0 to 350 feet wide.

The surrounding landuse and the habitat conditions of the project sites limit the species to those typical of suburban areas. The USFWS (Walsh 2004) states that 43 species of birds are likely to use this riparian corridor. Birds expected to utilize the project area include mourning dove (*Zenaida macroura*), northern cardinal (*Cardinalis cardinalis*), American robin (*Turdas migratorius*), European starling (*Sturnus vulgaris*), American crow (*Corvis*

brachyrhynchos), black-capped chickadee (*Parus atricapillus*), blue jay (*Cyanocitta cristata*), common grackle (*Quiscalus quiscula*), house finch (*Carpodacus mexicanus*), northern mockingbird (*Mimus polyglottos*), red-winged blackbird (*Agelaius phoeniceus*), tufted titmouse (*Parus bicolor*), several sparrow species (Subfamily Emberizinae) and woodpeckers (Order Piciformes).

Figure 6: National Wetlands Inventory wetlands.



Other wildlife in the areas includes white-tailed deer (*Odocoileus virginianus*), raccoons (*Procyon lotor*), gray squirrel (*Sciurus carolinensis*), opossum (*Didelphis virginiana*), field mice (*Peromyscus* spp.) and several common species of bats (Family Vespertilionidae). No reptile, amphibian, or fish species were observed. Fish species that are likely to live in the stream include American eel (*Anguilla rostrata*), minnow species (Family Umbridae), sunfish (Family Centrarchidae), carp (Family Cyprinidae), pickerel (*Esox* sp.), killifish (Family Cyprinodontidae), and largemouth bass (*Micropterus salmoides*). See Appendix A for further information.

4.6 Threatened and Endangered Species

No federally listed species are known to exist in the project area (Walsh 2004). The USFWS has reported that there are also no state–listed rare, threatened or endangered species in the study area, however the wood thrush (*Hylocichla mustelina*) is a species of management concern to the USFWS within this region. This thrush inhabits deciduous and mixed forests throughout eastern North America, preferring areas of tall trees with a shrub subcanopy and an open forest floor with leaf litter (Cornell University 2004). Wood thrushes are often found near water where they forage for invertebrate prey such as beetles, flies, earthworms, spiders and sow bugs. In recent years, the wood thrush has undergone an alarming population decline (Cornell University 2004). Suggested causes include habitat loss in its winter range and forest fragmentation in its breeding range (Cornell University 2004).

4.7 Environmental Justice

The Garden State Parkway is a major artery for traffic in New Jersey. Sustaining this road and its access roads helps to maintain the local economy, as well as allowing the movement of emergency vehicles. The surrounding land use, beyond the highway, is residential and commercial. Reach 2 is also directly adjacent to a public school facility. The primary social and economic concern for the physical environment of the project area would be an interruption in the ability of the school to function and interrupting the lives of the abutting landowners.

The area surrounding the project site has a population of approximately 5000 persons. Of this, approximately 51% are minorities. About 47% of the population over 25 years old has completed a bachelor's degree or more, while almost 12% have not completed high school. Almost 3% of the population is living below poverty level, and about 41% earn over $75,000 per year (USEPA 2004).

4.8 Cultural Resources

Historical research and collection of background materials was carried out for the proposed project area at the New Jersey State Historic Preservation Office (NJSHPO), the New Jersey State Museum, the New Jersey State Library and the Woodbridge Township Library. The Woodbridge Historical Preservation Commission was contacted for information on the project area. A site visit was conducted on January 23, 2004 at the locations of proposed work and shovel tests were performed in the project locations between April 5 and April 14, 2005. This cultural resources study has been conducted in order to ensure that the project complies with Section 106 of the National Historic Preservation Act of 1966, as amended. Other regulations that specifically apply to this cultural resources investigation include Section 101(b)(4) of the National Environmental Policy Act of 1969 and the Advisory Council Procedures for the Protection of Cultural Properties (36 CFR Part 800).

The Native Americans who occupied the area of Middlesex County are called the Lenni-Lenape. The project has been crossed by Native Americans over many centuries in their yearly migrations from the Hudson River to the Delaware River or from the Minisink

Mountains in the north to the shores further south. The route of the east-west Assupink trail once followed what is now Green Street, turning north to cross the south branch of the Rahway River east of the study area and then crosses the study area in the vicinity of Route 27 and the Middlesex-Essex Turnpike (Perry and Miller 1975).

European settlement began in the area in the mid-Seventeenth Century. Subsistence for most of the people of Woodbridge remained farming until the 19th Century (Modica and Bourgeois 2001). Iselin was once called Perrytown, and then Union Town during the Civil War. Union soldiers camped in town during the Revolutionary War and it is believed that the town was named Union Town for that reason. The village developed around the intersection of Green Street and Chain o'Hills Road (once called Queen Annes Road) (Perry and Miller 1975). Railroad development in the second half of the 19th Century increased the number of settlers in the area by providing a reasonably fast and practical method of transportation into the cities nearby. When the Lincoln Highway (Route 27) was completed in the 1920's, it served to carry people from town east to Jersey City or west to Trenton. Following Word War II, Woodbridge's population soared and it began to develop into a commuting suburb of New York City. Construction of the Garden State Parkway finally cemented its fate and Woodbridge developed quickly as a result.

Research in the archaeological site files at the New Jersey State Museum and National Register of Historic Places (NRHP) files at the New Jersey State Historic Preservation Office (NJSHPO) did not locate previously identified archaeological sites in the project area. There is, however, a prehistoric archaeological sensitivity zone identified running east-west on the southern side of U.S. Route 27 between Reaches 3 and 4. The area has not been explored archaeologically since the time it was identified and no sites are currently known within the area.

There are two historic districts that are eligible for listing on the NRHP within the project area. The project area runs along the Garden State Parkway for its entire length. A second property that is eligible for listing on the NRHP and located within the project area is the Port Reading Railroad Historic District. The railroad line runs adjacent to Reach 2. Shovel test pitting at the project locations identified no additional significant prehistoric or historic cultural resources.

4.9 Site Contamination

Consulting the NJDEP database of "Known Contaminated Sites List" (KCL), a search of Woodbridge Township was conducted. The township has 146 sites with known and unknown sources of contamination. The KCL includes the street address of the site, NJDEP bureau managing the site, date the site went on the list, status, and case number. Reviewing the list, it was determined that none of the listed sites were immediately adjacent to the area of study. There are two gasoline stations on the Garden State Parkway nearby the study area. These gas stations are listed on the KCL as active with ongoing remediation. Leaking underground storage tanks (UST) is sited as the reason for state oversight. No other USTs were found adjacent to the study area. Other nearby KCLs included contaminated soils from past industrial activities.

4.10 Air Quality

The USEPA measures community-wide air quality based on daily measured concentrations of six criteria air pollutants; carbon monoxide, sulfur dioxide, respirable particulate matter, lead, nitrogen dioxide, and ozone. Based on these measurements of air quality, the USEPA designates attainment areas and non-attainment areas nationwide. Non-attainment areas are designated in areas where air pollution levels persistently exceed the national ambient air quality standards.

Middlesex County is located in the New York-New Jersey-Long Island Air Quality Control Region. Similar to most urban industrial areas, emissions from automobiles, manufacturing processes, utility plants, and refineries have impacted air quality in the Project Area. Based on the National Ambient Air Quality Standards (NAAQS) six primary pollutants, Middlesex County is designated as a non-attainment area for ozone and carbon monoxide and an attainment area for sulfur dioxide, respirable particulate matter (PM10), lead and nitrogen oxide.

The analysis for this project focused on NOx emissions, as this is generally the limiting factor for USACE projects. Table 1 shows the rough estimates for the equipment anticipated for this project. Exact equipment types are unknown, as they will be based on the contractors who bid on the construction, however these estimates are based on previous similar projects. These numbers also utilize Tier 1 standards to allow for the use of older vehicles. If newer vehicles are utilized, actual emissions will be lower than estimated. As estimated the total NOx emissions for this project is 1.43 tons/year.

Table 1: Emissions estimates for individual equipment types.

Equipment	Hours	Horse-power	Load Factor	NOx EF (g/hp-hr)	NOx tons
Backhoe	1376	99	21%	6.9	0.22
Dump Truck	536	518	59%	5.0	0.90
Truck Crane (Gradall)	80	300	59%	5.0	0.08
Flat Bed Truck	80	300	59%	5.0	0.08
Crane	40	350	43%	7.6	0.05

Equipment	Hours	Avg. Speed	NOx EF (g/mile)	NOx tons
Pickup Truck	1600	45	1.25	0.099

4.11 Cumulative impacts

Between the 4 reaches shown to have federal interest and discussed in this EA, the NJTA has also pinpointed other areas that they are interested in stabilizing independently. These areas will be funded solely by NJTA but will be constructed under the same contract as the joint USACE NJTA work so as to minimize impacts to the local community. The separate NJTA work will include approximately 735 linear feet of the streambank, in about 10 discontinuous segments of 10 to 200 feet in length. Over 700

feet of the repairs will be done with vegetated gabions, the remaining repairs include installing riprap or repairing/replacing concrete aprons.

USACE also has other projects in nearby areas, including the Rahway Basin Project, the Woodbridge River Basin Project, a section 1135 Project along the Rahway River, a possible mitigation site also in Woodbridge, and numerous proposed sites for the NY/NJ Harbor Estuary Program (HEP).

The Rahway Basin Project is a flood protection and ecosystem restoration project (USACE 1999). This study encompasses the entire Rahway River Basin, which does include the South Branch study area. This study focuses on two main flood hazard areas along the Robinson's Branch and the South Branch. The flood protection work on the South Branch is focused near the intersection of Route 27 and Route 35. There are also 4 ecosystem restoration areas that are being considered, along the mainstem of the Rahway, along the Robinson's Branch, ad along the East Branch.

The Woodbridge River Basin Project is also a flood control and ecosystem restoration project (USACE 2003). The study area includes the basin for the entire Woodbridge river, which is just east of the South Branch study area.

The Section 1135 Rahway River Project is located at the confluence of the South Branch of the Rahway River and the Rahway River (USACE 2004). The 1135 project looks at restoring wetlands that were lost during the construction by USACE of a flood control levee in 1966. Approximate construction date for this project is 2007.

The Woodbridge wetland mitigation site is a mitigation site for impacts caused by the NY/NJ Harbor Deepening Project. The site is located along the Woodbridge River and is slated for construction in 2005-2006.

The HEP is one of 28 National Estuary Programs established under Section 320 of the Clean Water Act. Projects include a variety of floodplain, shallow water, riparian, wetland, and upland habitat creation, restoration and enhancement activities. There are a number of proposed sites along the Rahway River and the Robinson's Branch of the Rahway River (USACE 2004).

5.0 ENVIRONMENTAL CONSEQUENCES

The following is a discussion of the potential environmental consequences of the considered alternatives and the recommended plan.

5.1 Landscape

The proposed alternative that would have the most significant environmental impact to the floodplain landscape would be Alternative 3, the construction of a riprap bank throughout the project area. This alternative requires extensive recontouring of the existing bank to decrease the slope, which will cause the loss of existing riparian trees while creating an unnatural stone streambank. This extensive regrading is also precluded

in many locations due to the proximity of structures at top-of-bank. Likewise, the use of just gabion baskets, Alternative 2, will create an unnatural bank, but the limited excavation would help preserve more of the existing riparian corridor trees and vegetation. It would be anticipated that there would be continued erosion of the streambank under the No-Federal Action Alternative (Alternative 1).

Alternatives 4 and 5 (willow stakes and willow stakes with a stone toe) would create a natural streambank, however they require extensive excavation to decrease the bank slopes, and as such would disturb the existing riparian zone. Alternative 7, the use of the crib walls would create a vegetated bank and would require less excavation, but the proximity of various structures at the top-of-bank would preclude use in many areas. Alternative 8, the construction of vegetated geogrid walls, would also create a natural streambank, but due to the limitations of this method its stability is uncertain for this project.

Vegetated gabions, Alternative 6, will create a more natural bank with vegetation that will shade the stream and provide organic matter. It will also limit the excavation that is needed for the vegetated geogrid or willow stake options. This limited excavation is expected to reduce the loss of existing riparian trees and is not expected to interfere with close structures.

All of the considered alternatives would involve temporary impacts to the landscape and to the access and staging areas. The transport and use of equipment on site will require some pre-staging with either soil erosion control mats, a temporary gravel based access road or other suitable surface to minimize disturbance. These access roads and staging areas will be located so as to minimize the loss of trees and disturbance to the existing habitat. Also all native trees lost to construction will be replaced with the same or similar species to the extent possible.

5.2 Water Resources

Environmental impacts to aquatic habitat and water quality would be greatest for Alternatives 2 and 3, the use of gabion baskets and riprap. The creation of an unnatural streambank will remove shading and thereby increase the temperature of the stream. It will also decrease the organic material load to the stream causing a starvation to the food web. The eventual growth of trees through the riprap could lessen the impact of this alternative, however this method would also require extensive excavation to decrease the grade of the banks, thereby increasing the loss of existing riparian vegetation and increasing runoff during and immediately post-construction. Installation of the gabions would also require excavation, but to a much lesser extent.

Alternatives 4 and 5, live stakes and live stakes with a stone toe, would also require extensive excavation and regrading of the banks to create a suitable slope for the plantings. This regrading would eliminate the existing riparian vegetation, and create more runoff during and immediately post-construction.

Alternative 7, using live crib walls, would eliminate the need for large-scale excavation however the top-of-bank would have to be regraded to lower the bank heights. In areas where the banks are high enough to exceed the stability threshold of the crib wall, the top-of-bank will need to be regraded and stabilized with willow stakes or other plantings. Some excavation would also be necessary to tie the structures into the bank, but complete regrading of the banks would not be necessary. The creation of a natural bank would provide organic material to the stream system and would continue to shade the stream.

Alternative 8, the construction of vegetated geogrid walls, would require extensive excavation to key the structures into the bank, having the same impacts as discussed above. Final bank profiles however will be similar to pre-construction profiles.

The recommended alternative creates a vegetated bank that will provide organic matter and shading to the stream system. It also requires limited excavation and as such will limit impacts to the existing riparian vegetation.

All of the considered alternatives will cause temporary adverse impacts to water quality through sedimentation and erosion associated with construction, direct impacts to aquatic habitat substrate, and temporary loss of fisheries and macroinvertebrate habitat during construction. These expected impacts would be mitigated through the use of sedimentation/erosion control devices such as silt screens and cofferdams during construction to minimize water quality impacts.

5.3 Wetlands

As discussed above, wetlands do exist in the project area, but on the banks opposite the proposed construction. These wetlands would be most impacted by installation of hard, non-vegetated structures (Alternatives 2 and 3) due to the need for heavier equipment as well as the loss of shading and decreased water quality. Alternatives 4 through 7 would both create a natural streambank that will not raise water temperatures and would continue to add plant material to the stream system. All of the proposed alternatives will help to reduce the high sediment load that is currently being added to the stream by the existing eroding banks. This sedimentation can deposit on the wetlands, causing loss of vegetation.

Wetland impacts can be avoided by not utilizing these opposite banks for access or staging areas during construction and by avoiding sedimentation through the use of best management practices such as straw bales, silt fences, turbidity curtains and others. All of the alternatives would also involve wetland permit coordination with NJDEP.

5.4 Fisheries and Wildlife Habitat

As discussed in Section 4.4, the existing habitat cover types within the study area support a variety of fish, birds, and mammals, both as foraging and breeding habitat. All of the considered alternatives would involve temporary impacts to fish and wildlife species in the area due to noise disturbance and increased presence of humans.

The environmental impacts outlined in Sections 5.1, 5.2 and 5.3 would have direct implications for the fisheries and wildlife supported by the resources of the landscape. Alternatives 2, 3, 6, and 8 could be expected to permanently alter the substrate type of a portion of the streambed and the riverbanks. Mammals, such as muskrats, or other animals that burrow into riverbanks would no longer be capable of doing so with the placement of hard structures, such as rip-rap, gabion baskets (vegetated or not) or the vegetated geogrid wall.

It is expected that the loss of some tree cover in the project area will result in diminished habitat conditions over the short-term. This loss of existing vegetation and disturbance of the soils associated with the excavation could be mitigated through reestablishment of vegetation post-construction. Alternative 2, the use of traditional gabion baskets, would require the removal of all trees from the bank and their discouragement from regrowth. Thus this alternative would permanently diminish riparian corridor habitat while also decreasing water quality by raising water temperatures and decreasing organic input to the system.

Alternative 7, construction of vegetated cribwalls, would involve the least environmental impact to fisheries and wildlife habitat due to the minimization of excavation and the use of biodegradable materials to create a natural streambank. Due to the steepness of the banks, the close proximity of structures, and the need for more structural stability that prevent the use of cribwalls and the vegetated geogrid walls, vegetated gabions are recommended. This method will create riparian habitat, shade the stream, and allow organic material input to the stream. Burrowing creatures will still be obstructed by the structure.

5.5 Threatened and Endangered Species

As discussed in Section 4.5, there are no federal- or state-listed threatened or endangered species known to use the study area. Therefore, all of the considered alternatives would be expected to have no impact to threatened or endangered species.

Impacts to the wood thrush, the species of management concern, could be avoided through minimization of disturbance to the existing riparian zone, and with alternatives that will return the riparian corridor to a natural wooded state. The vegetated gabions meet both of these criteria.

5.6 Environmental Justice

Achieving Environmental Justice requires “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies” (USEPA 2005). Much of this project is directly adjacent to homes, cultural resources (Beth Israel Cemetery), or public infrastructure (including a the Menlo Park Terrace School parking area, Gills Lane, the Route 1 entrance ramp, and the Garden State Parkway). The limitations of space caused by these structures restricts the

alternatives to gabion baskets, crib walls or vegetated gabions, which do not require extensive regrading of the existing streambanks to suitable slopes.

The impact to the local population will be temporary, as caused by the increases of traffic and noise in the areas due to construction. This will be limited by placement of stockpiles, and access points where they will be least disruptive and by timing the work to avoid excessive noise during off-work hours. Construction near the Menlo Park School should be coordinated with the school officials to limit the impact to their work, as well as to ensure the safety of the students. Construction of this project will not cause adverse health or environmental impacts to minority or low-income populations.

5.7 Cultural Resources

There are two historic districts that are eligible for listing on the NRHP within the project area. The first is the Garden State Parkway (GSP). Boundaries of the district include all land and features historically associated with the GSP and were defined as the entire right-of-way acquired and developed for the GSP within the period of significance, 1945-1957. Certain sections of the project will overlap land that is part of the GSP right-of-way but the alterations that will be made will be minor and will protect the GSP by stabilizing the stream banks and roadways. A second property that is eligible for listing on the NRHP and located within the project area is the Port Reading Railroad Historic District. The railroad line is adjacent to Reach 2, but project plans will have no effect on the property. There will be no impact to the railroad and its associated features. No other cultural resources are located within the project area.

A previously identified (section 4.8), prehistoric archaeological sensitivity zone is located between Reaches 3 and 4. It is located south of the Middlesex-Essex Turnpike and Route 27, terminating on the west side at the Garden State Parkway and having its eastern end at the end of McFarlan Road. Project plans do not overlap this area; nonetheless, the project area, particularly the reaches near to this sensitivity zone, was believed to possess a moderate potential for prehistoric cultural resources where ground disturbance has been minimal. Testing was not required at Reach 4 however shovel testing was undertaken at Reach 3 to determine whether there were intact prehistoric deposits in the project boundaries.

Due to the believed moderate potential for buried prehistoric cultural resources within the project area, archaeological test pitting was conducted between April 5 and April 15, 2005 in areas where soils were believed to be intact within the project area. A total of 33 archaeological test pits were excavated at Reaches 1, 2 and 3. No prehistoric or historic archaeological sites were identified as a result of these investigations. The project is therefore not expected to impact cultural resources.

5.8 Site Contamination

No KCLs were found immediately adjacent to the construction areas and all of the KCLs found near the study area are distant enough as to pose minimal risk. As minimal soil excavation will be necessary, it is considered that there is minimal risk of encountering contaminated soil or groundwater during construction of slope stabilization structures.

5.9 Air Quality

Heavy equipment used during construction may contribute minor amounts of pollutants in the immediate vicinity of the project. However, construction activities will have no significant or long-term impact on air quality. Emission calculations based upon the equipment inventory developed to construct the project have determined that the emissions resulting from the project remain far under the NAAQS criteria threshold. A draft Record of Non-Applicability and associated calculation is provided in Appendix C.

5.10 Cumulative Impacts

The cumulative impacts associated with construction of these four reaches as well as the NJTA locations and are not expected to be significant. Construction of both of these projects would occur simultaneously with one to two small locations being worked on at a single time. It is expected that any wildlife, including fish, birds, etc., in the location of the construction would find enough similar habitat in nearby areas to occupy during any disturbance. Disturbances to water quality would be controlled with silt fencing, turbidity curtains, and other best management practices, such that the cumulative impacts of these constructions are not expected to exceed that seen from current erosion during a storm event.

By doing both the federal project and the NJTA project under one contract it would minimize the impact to the local citizens by decreasing the construction traffic and noise that would be associated with two groups working simultaneously. It would also limit the environmental impact associated with an increase in concurrent construction zones. It is also more cost effective for the public in that a single mobilization and demobilization is needed for both stabilization projects.

Cumulative long-term impacts to the immediate area are expected to be beneficial. Stabilization of the streambank in the USACE and NJTA areas would allow plant growth along currently bare soil banks. This would also help to decrease the sediment load to the stream system. The unnatural bank will pose a problem to burrowing animals, but is limited in scope so that other nearby habitats could be used along the stream. Overall, the stream and the adjacent habitat are expected to benefit from this restoration.

The other known USACE projects are not expected to be impacted by this work and are not expected to impact this project. Most of cumulative negative impacts to the watershed would be negligible.

5.11 Environmental Compliance

Table 2: Summary of Primary Laws and Regulations Applicable to the Proposed Project

Legislative Title and code/date		Compliance
Advisory Council Procedures for the Protection of Cultural Properties	36 CFR Part 800	The Corps has continued to coordinate with the State Historic Preservation Office to fulfill requirements.

Legislative Title and code/date		Compliance
American Indian Religious Freedom Act of 1978	42 USC 1996	This project will not impede access by Native Americans to sacred sites, possession of sacred objects, and freedom to worship through ceremonials and traditional rites.
Clean Air Act	42 U.S.C. §§ 7401-7671g	An air quality analysis was completed for the project. Based upon the completed analysis, the emissions from the project are considered to have an insignificant impact on the regional air quality, and according to 40 CFR 93.153 (f) and (g) the proposed project is presumed to conform to the SIP.
Clean Water Act of 1977	33 U.S.C. §§ 1251 et seq.	A section 404(b)(1) Evaluation and Compliance Review has been incorporated into this report (see Appendix B). An application will be filed for a state water protection permit, pursuant to Section 401 of the Clean Water Act.
Coastal Zone Management Act of 1972 and NJ Coastal Permit Program and Management Rules	16 U.S.C. §§ 1451-1464 N.J.A.C. 7:7 and N.J.A.C. 7:7E	These codes are not applicable as this stream is nontidal freshwater.
Comprehensive Environmental Response, Compenation, and Liability Act (CERCLA)	42 USC 9601-9675	The project has been evaluated in reference to this act. No evidence that there are any hazardous substances on lands necessary for project construction, operation and maintenance. Project is in compliance with this act following state and federal agency concurrence with the findings of this EA.
Endangered Species Act of 1973; NJDEP Endangered and Nongame Species Conservation Act	16 U.S.C. §§ 1531 et seq.; N.J.S.A. 23:2A-1 to -13	Information provided by the U.S. Fish and Wildlife Service indicates that the proposed project will not have adverse impacts to any endangered or threatened species.
Fish and Wildlife Coordination Act	16 U.S.C. § 661 et seq.	USACE has coordinated with the U.S. Fish and Wildlife Service. See Appendix A.
Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996	16 U.S.C. § 1801 et seq.	The project occurs in fresh water that does not host anadromous fish runs. This act is not applicable.
National Environmental Policy Act of 1969	42 U.S.C. §§ 4321-4347	The circulation of this Draft Environmental Assessment fulfills requirements of this act. Section 101(b)(4) for cultural resources investigations. Coordinating with SHPO.
National Historic Preservation Act of 1966, as amended	16 U.S.C. §§ 470 et seq.	USACE has continued to coordinate with the NJSHPO to fulfill requirements of this act.
Safe Drinking Water Act	42 USC § 300f et seq.	Addressed in the EA, no impact expected
Watershed Protection and Flood Prevention Act	16 USC 1001 et seq.	Floodplain impacts have been considered in project planning and are discussed in this document.

Legislative Title and code/date		Compliance
Wild and Scenic Rivers Act	16 USC 1271 et seq.	The project does not contain Wild and Scenic Rivers.
Executive Order 11593, Protection and Enhancement of the Cultural Environment	13 May 1971	Coordination with the State Historic Preservation Officer signifies compliance.
Executive Order 11990, Protection of Wetlands	42 FR 26961	Circulation of this report for public and agency review fulfills the requirements of this order.
Executive Order 11988, Floodplain Management (amended by Executive Order 12148)	24 May 1977 (20 Jul 1979)	The proposed project will not stimulate development in the floodplain. Circulation of this report for public and agency review fulfills the requirements of this order.
Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Population and Low Income Populations	11 February 1994 [59 FR 7629]	The project is not expected to have negative impacts on minority or low income populations or any other population of the United States. Circulation of this report for public and agency review fulfills the requirements of this order.
Executive Order 13007, Accomodation of Sacred Sites	24 May 1996	Not applicable on non-federal lands. Project will not impede access to or ceremonial use of sacred sites by Native Americans on federal lands, nor will it affect the physical integrity of any such sacred sites.
Executive Order 13175, Consultation and Coordination with Indian Tribal Governments	6 November 2000	Consultation with Indian Tribal Governments, where applicable, and consistent with executive memoranda, DoD Indian policy, and USACE Tribal Policy Principles signifies compliance.
Executive Order 13405, Protection of Children from Environmental Health Risks and Safety Risks	21 April 1997	This project will not create a disproportionate environmental health or safety risk for children
New Jersey DEP Rules and Regulations – Stream Encroachment	N.J.A.C. 7:13 (N.J.S.A. 58:16A)	Permit applied for and received, addressed in EA, no impact expected
New Jersey DEP Rules and Regulations – Freshwater Wetlands Permit # 16	N.J.A.C. 7:7A (N.J.S.A. 13:9B)	Permit applied for and received, addressed in EA, no impact expected
Wetlands Act of 1970	N.J.S.A. 13:9A	Addressed in EA, no impact expected

6.0 SUMMARY

In summary, USACE and the NJTA arrived at *Alternative 6: Bank Stabilization with Vegetated Gabion Baskets* as the optimal plan for the proposed federal action based on evaluation of potential environmental impacts, feasibility of the approach, and comprehensiveness of the solution. This alternative would achieve the goal of providing stabilized banks and thereby protecting the public infrastructure in the area. The anticipated environmental impacts of Alternative 6 are acceptable and temporary in comparison with other considered alternatives. Environmental impacts for this alternative can be minimized during construction through development of a sedimentation and erosion control plan, by selecting staging areas outside of sensitive

areas, and through coordination of construction schedules with the landowners (particularly the Menlo Park Terrace School) to minimize impacts to the local population.

The project will be coordinated with NJDEP and the local government to obtain all applicable permits for implementation of the proposed action. Cultural resource coordination will continue with the State Historic Preservation Office to verify the lack of adverse affects on historic and archaeological resources. At this time, it is anticipated that the proposed federal action would not have a significant adverse impact on the environment, and that an Environmental Impact Statement under NEPA would not be required for this project.

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APPENDIX A: DRAFT FISH AND WILDLIFE COORDINATION ACT REPORT

DRAFT
FISH AND WILDLIFE COORDINATION ACT
SECTION 2(b) REPORT

ASSESSMENT OF THE SOUTH BRANCH OF THE RAHWAY RIVER EMERGENCY STREAMBANK STABILIZATION PROJECT, WOODBRIDGE, MIDDLESEX COUNTY, NEW JERSEY

Prepared for:

U.S. Army Corps of Engineers
New York District
New York, New York
10278-0090

Prepared by:

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EXECUTIVE SUMMARY

Under the Flood Control Act of 1946, the U.S. Army Corps of Engineers (Corps) is authorized to allot funds for the construction, repair, restoration, and modification of emergency streambank and shoreline protection works to prevent damage to highways, bridge approaches, and public works; and to churches, hospitals, schools, and other non-profit public services. Under this authority, the Corps proposes to conduct streambank stabilization and outfall repairs along four sections of the eastern fork of the South Branch of the Raritan River in Woodbridge, Middlesex County, New Jersey. This approximately 2.0-mile stretch of the South Branch and another unnamed tributary runs roughly parallel to the Garden State Parkway between miles 130.5 and 132.2. Erosion in this area threatens sections of the Parkway including on and off ramps, a local Parkway access street (Gill Lane), and the Menlo Park elementary school. The Corps proposes bank stabilization using live cribwalls and/or a vegetated geogrid wall system; either structure would be revegetated. The Corps would stabilize outfall structures mainly using rip rap.

The South Branch of the Rahway River Emergency Streambank Stabilization Project is expected to have minor effects on hydrologic balance, sediment processes, and chemical processes of approximately 2.0 miles of stream, primarily by reducing erosion in these areas. The Service expects the project will generally benefit water quality and wildlife resources by reducing sedimentation and turbidity. The Service has provided recommendations for the Corps to improve water quality and stream conditions further by improving stormwater management in certain localized areas. The Service anticipates the project would have negligible effects on morphologic stream processes (*i.e.*, prevention of lateral migration), but would incrementally contribute to the further prevention of stream migration.

The primary effects of the project would be on riparian vegetation and wildlife habitat on the banks of project area streams. These effects may be beneficial or adverse to wildlife resources, depending on the selected stabilization method(s) and bank revegetation plans. Accordingly, direct effects on riparian vegetation and wildlife habitat are the focus of the Service's recommendations for the project. With proper sediment and erosion control, temporary adverse effects of the project should be minimal.

Key Service recommendations include:

- address the underlying causes of erosion;
- minimize structural stabilization and maximize vegetative stabilization;
- prepare and implement a construction plan to protect existing riparian vegetation;
- prepare and implement a planting (revegetation) plan;
- prepare and implement a monitoring and adaptive management plan;
- seek opportunities for incidental environmental enhancements; and
- implement best management practices for erosion and sediment control.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

I. INTRODUCTION

This constitutes the U.S. Fish and Wildlife Service's (Service) Fish and Wildlife Coordination Act, (48 Stat. 401; 16 U.S.C. 661 *et seq.*) (FWCA) Section 2(b) report describing the fish and wildlife resources and supporting ecosystems in the area of the proposed South Branch of the Rahway River Emergency Streambank Stabilization Project. This report is provided in accordance with a Fiscal Year-2004 scope of work and funding transfer agreement dated March 5, 2004, between the New York District, U.S. Army Corps of Engineers (Corps) and the Service's New Jersey Field Office. Information presented in this report documents the fish and wildlife resources in the project area, describes project effects, and provides Service recommendations to benefit fish and wildlife. The project area is located along approximately 2.0 miles of the South Branch of the Rahway River in Woodbridge, Middlesex County, New Jersey (Figure 1). The non-federal sponsor for the project is the New Jersey Turnpike-Garden State Parkway Authority; however, there would be no non-federal cost share for construction as the proposed project is authorized under Section 14 of the Flood Control Act of 1946, as amended (P.L. 79-526) (U.S. Army Corps of Engineers, 2004).

The Service requests that no part of this report be used out of context, and if the report is reproduced, it should appear in its entirety. Furthermore, any data, opinions, figures, recommendations, or conclusions excerpted from this report should be properly cited and include the page number from which the information was taken. This report should be cited as follows:

Walsh, W.L. 2004. Assessment of the South Branch of the Rahway river emergency streambank stabilization project, Woodbridge, Middlesex County, New Jersey. Draft Fish and Wildlife Coordination Act Section 2(b) Report, U.S. Department of the Interior, Fish and Wildlife Service, New Jersey Field Office, Pleasantville, New Jersey. 17 pp. + appendices.

Questions or comments regarding this report are welcomed by the Service. Written inquiries should be addressed to:

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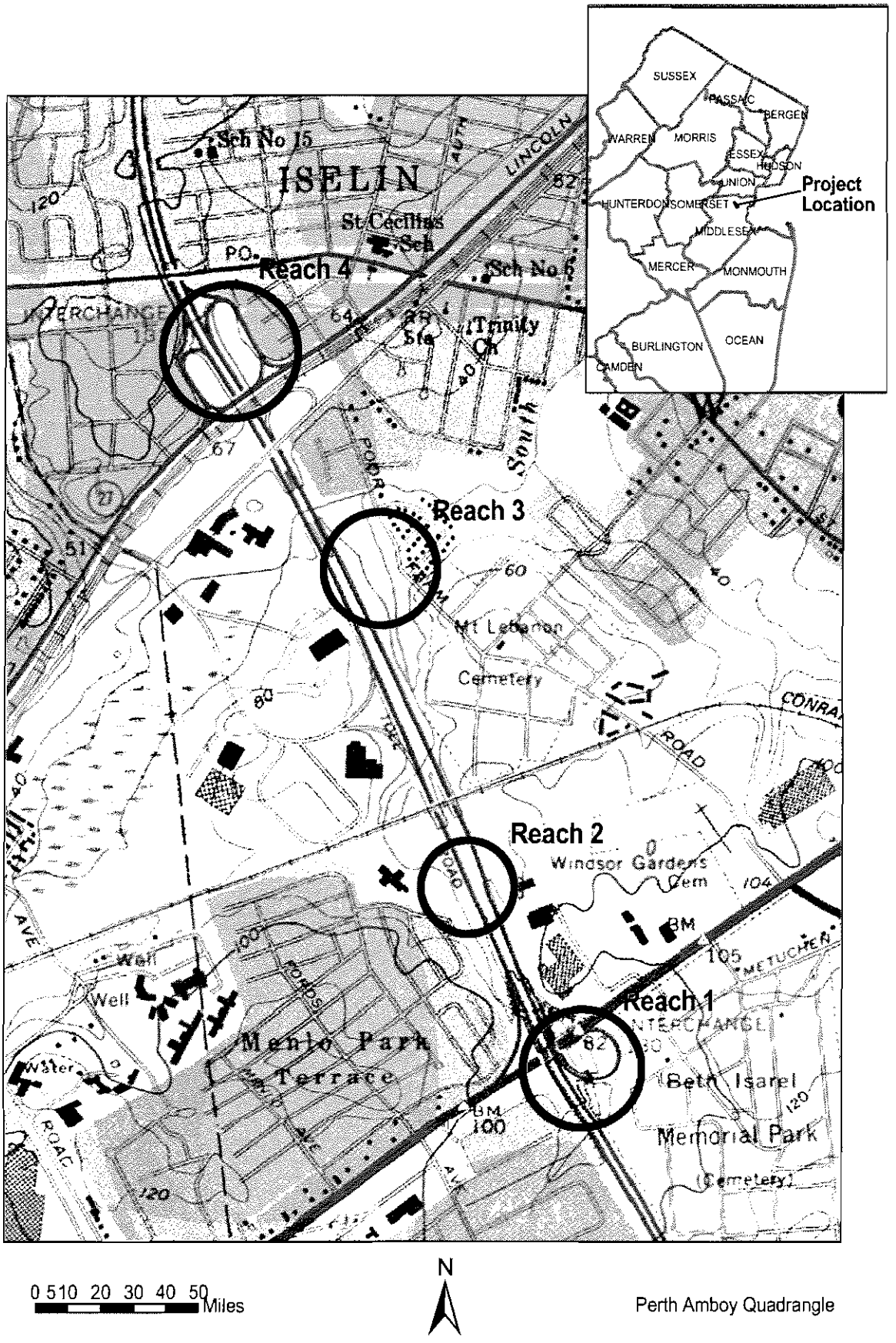


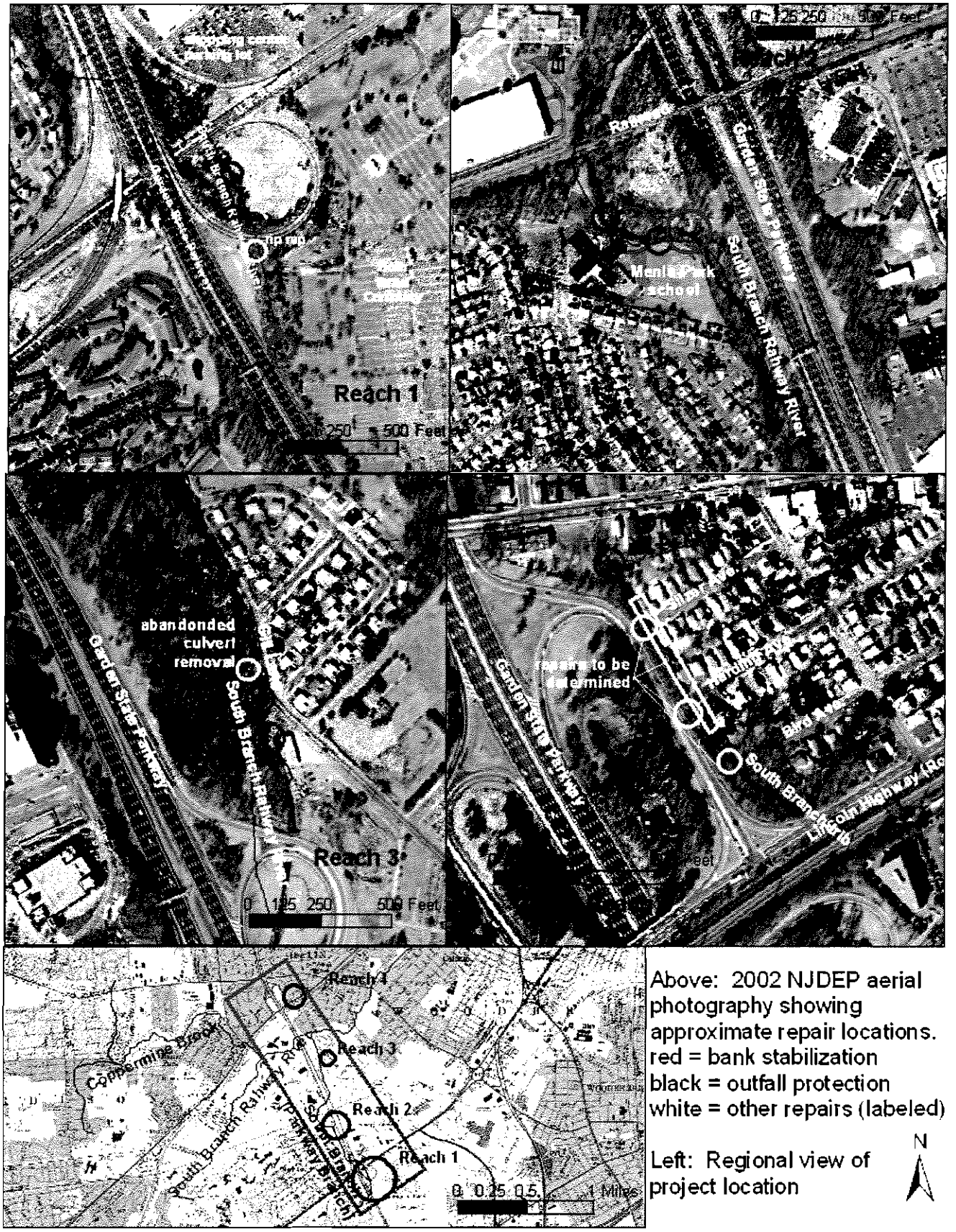
Figure 1. Project Location

II. PROJECT DESCRIPTION

Under the Flood Control Act of 1946, the Corps is authorized to allot funds, within certain limits, for the construction, repair, restoration, and modification of emergency streambank and shoreline protection works to prevent damage to highways, bridge approaches, and public works; and to churches, hospitals, schools, and other non-profit public services (The Louis Berger Group, 2002). Under this authority, the Corps proposes to conduct streambank stabilization and outfall repairs along four sections of the eastern fork of the South Branch of the Raritan River (also known as the Parkway Branch; the South Branch in this report) in Woodbridge, Middlesex County, New Jersey (Figure 2). This approximately 2.0-mile stretch of the South Branch (and another unnamed tributary) runs roughly parallel to the Garden State Parkway (GSP) between miles 130.5 and 132.2. Erosion in this area threatens sections of the GSP including on and off ramps, a local GSP access street (Gill Lane), and the Menlo Park elementary school. The project area is divided into four reaches.

Reach 1 is located near the headwaters of the South Branch, which flows roughly north through a culvert under the GSP, through a short section of the Beth Israel Cemetery, under a highway loop connecting Route 1 and the GSP, along a short wooded slope at the base of the GSP adjacent to a shopping center parking lot, and finally back under the GSP (Figure 2). Within Reach 1, five sections of streambank totaling approximately 535 feet are proposed to be stabilized using live cribwalls, according to the Corps 50 percent design plans dated December 31, 2003. These plans also show a small area to be stabilized with rip rap along a deep V created where the graded slopes of the GSP and the highway loop meet. Finally, the Corps proposes conduit outlet protection using rip rap and filter fabric in the vicinity of a 54-inch stormwater pipe within the highway loop. There is a 2.5-foot drop from this pipe outlet to a concrete apron below the pipe (The Louis Berger Group, 2002).

Reach 2 is located approximately 1,500 feet downstream of Reach 1. In this area, the South Branch flows north between the GSP and Menlo Park elementary school (Figure 2). The Corps' 2003 plans show a section of bank about 250 feet long on the GSP side to be stabilized with a cribwall. Within this stabilization area, a concrete slab in the stream, connecting the school to an unused dirt road, would be demolished. Plans call for stabilizing a second section of streambank in Reach 2, about 300 feet long on the school side, but the specific stabilization method has not yet been selected. In this second stabilization area, a concrete cover over the top of the South Branch has deteriorated, resulting in failure of the bank. The failing bank is immediately adjacent to the school playground, and approximately 20 feet from the school building at the closest point (The Louis Berger Group, 2002). In Reach 2, the Corps also proposes to protect two stormwater pipes that drain portions of the school property using rap rap and filter fabric. Discharges from these pipes are causing erosion.



Above: 2002 NJDEP aerial photography showing approximate repair locations.
red = bank stabilization
black = outfall protection
white = other repairs (labeled)

Left: Regional view of project location

Figure 2. Repair Locations

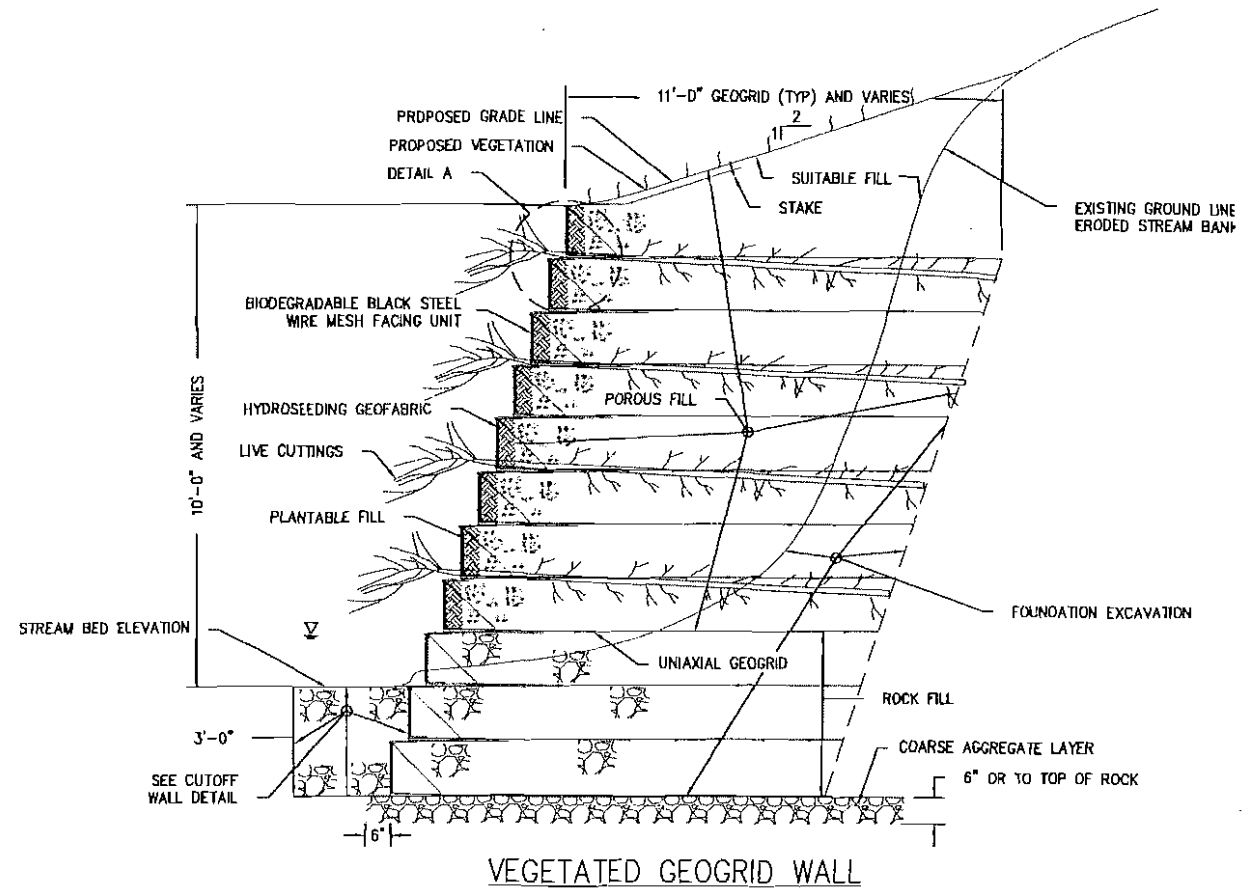
Reach 3 is located approximately 2,500 feet downstream from Reach 2. In this area, the South Branch flows north and is located more than 300 feet from the GSP, but immediately adjacent to a bend in Gill Lane (Figure 2). The Corps' 2003 plans show two sections of streambank on the Gill Lane side, roughly 100 feet each, to be stabilized with cribwalls. The Corps also plans to demolish a large, abandoned dual culvert structure that has caused a blow out of the stream and formation of a deep pool.

Reach 4 is located about 1,500 feet north of the confluence of the eastern fork (Parkway Branch) and western fork of the South Branch. Reach 4 contains an unnamed tributary of the South Branch, which flows south in a deep, narrow channel between a GSP access ramp and a residential neighborhood (Figure 2). Banks on the GSP side are nearly vertical, incised into a red rock material. On the residential side, banks are steep and vegetated downstream, with sections of vertical concrete bag wall and concrete retaining wall further upstream. The narrow stream bottom consists of bare rock material. Utility pipes are exposed downstream, and a stormwater outfall at the upstream end is causing erosion. At the outfall pipe, the Corps proposes conduit outlet protection using rip rap and filter fabric, a concrete headwall, and rip rap bank stabilization. To our knowledge the Corps has not yet selected stabilization, repair methods or specific locations for other portions of Reach 4. Recent discussions suggest that only limited activities are currently proposed, such as repairing the concrete bag wall where it is undermined (McClain, pers. comm., 2004).

Recent communications from the Corps indicate that some or all sections of proposed live cribwall may be replaced with a vegetated geogrid wall (Figure 3). While cribwalls would be constructed of live branches, fill material, and logs, the geogrid wall would be comprised of biodegradable black steel wire mesh facing units filled with plantable material. The face of the geogrid wall would be planted. The Corps proposes this change because recent analysis found the wood cribwalls to be unstable over a certain height (in the range of 4-7 feet). We understand that Corps engineers have also questioned the ability of cribwalls to withstand high water velocities when inundated (lower sections of wall would be overtopped by a 10-year flood), and determined that the geogrid wall would be easier to construct (McClain, pers. comm., 2004).

III. METHODS

The information and findings presented in this report are based on review of the Corps December 2003 project plans and more recent plan revisions provided via personal communication from Corps staff. The Service also reviewed the November 2002 Initial Appraisal Report South Branch Of Rahway River Section 14 Emergency Streambank Restoration final report prepared for the Corps by the Louis Berger Group (2002). The content of this FWCA Section 2(b) report is also based on Service files and literature, coordination with other agencies, and a March 23, 2004 site visit conducted with Corps staff.



VEGETATED GEOGRID WALL

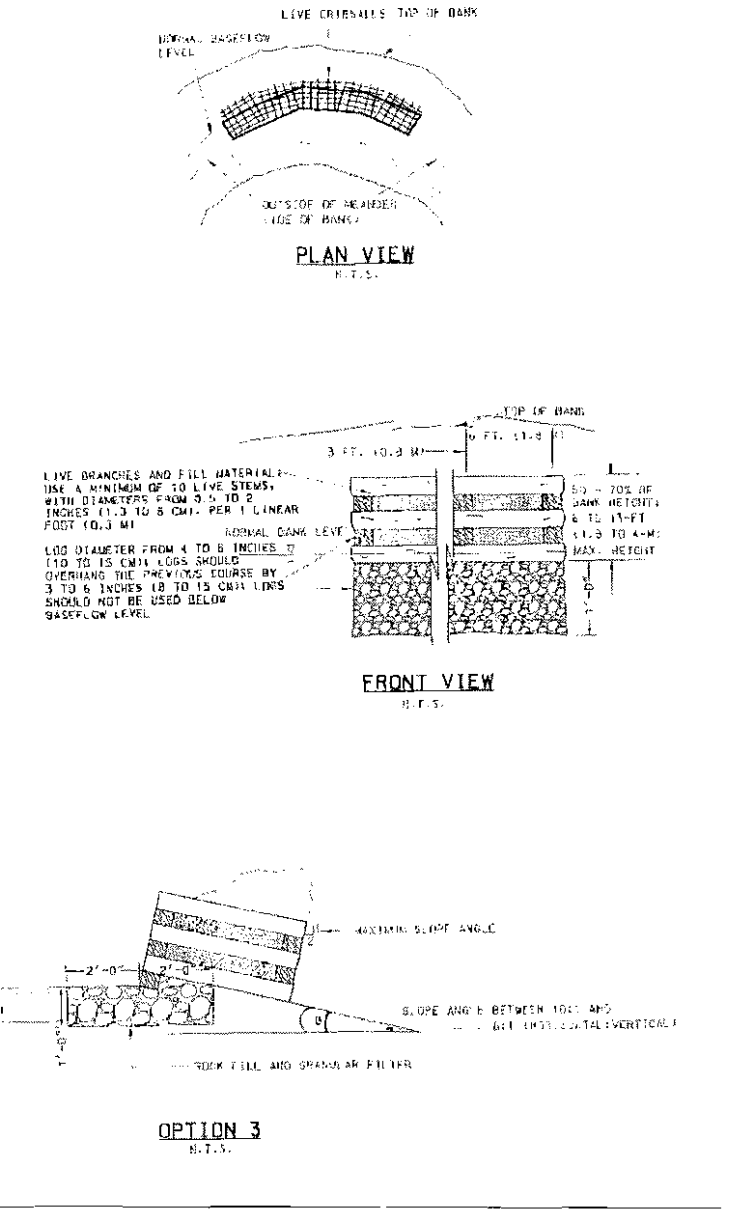


Figure 3. Vegetated Geogrid Wall Versus Live Cribwall Designs

IV. EXISTING CONDITIONS

A. PHYSICAL CHARACTERISTICS

The South Branch and the unnamed tributary are surrounded by suburban development. The narrow riparian corridor flanking the streams provides the only substantive wildlife habitats in the area. In Reach 1, the riparian corridor is approximately 150 to 200 feet wide, except north of Route 1 where the small wooded patch is approximately 300 feet wide. In Reach 2, the riparian corridor is also about 150 to 200 feet wide, but most of this width is located on the GSP side; the stream channel is close to the school. An old field is located at the top of the steep banks on the GSP side; this area is apparently an abandoned recreational field that now contains substantial amounts of trash. The riparian corridor is widest in Reach 3, roughly 400 feet, and mostly located on the GSP side (the stream channel is close to Gill Lane). The riparian corridor is narrowest in Reach 4 along the unnamed tributary, typically only about 40 feet wide.

In Reach 1, stream banks are typically about 8 to 10 feet high, with slopes of 3H:1V or steeper. Stream width (from the tops of the banks) is generally 5 to 15 feet. In Reach 2, the channel is approximately 30 feet wide. Within stabilization areas, the bank on the GSP side is about 10 feet high, while the bank on the school side is about 5 feet high; both sides are nearly vertical. In Reach 3, banks on the GSP side are low and gently sloping; wetlands may be present in this area. On the Gill Lane side, banks are 10 to 15 feet high and as steep as 1H:3V. The channel in this area is 4 to 8 feet wide. In Reach 4, banks upstream are 10 to 12 feet high, while banks further downstream are 4 to 6 feet high. Bank slopes range from 2H:1V to 1H:1V, with vertical sections along the concrete bag and concrete retaining walls. The stream is 4 to 5 feet wide in Reach 4 (The Louis Berger Group, 2002).

B. VEGETATION

In Reaches 1 through 3, the riparian corridor contains a mid-successional oak (*Quercus* spp.) dominated, wooded cover type. An obligate wetland species, skunk cabbage (*Symplocarpus foetidus*), was observed on the GSP side of Reach 3. The oak-dominated forested cover type was not present in Reach 4. Much of the bank on the GSP side is too steep to support any vegetation in Reach 4, although a few trees are present at the tops of the banks. On the downstream end of Reach 4, the residential-side banks support a shrubby community that generally consists of non-native species, including Japanese knotweed (*Polygonum cuspidatum*), bamboo (*Phyllostachys* sp.), and cultivated garden plants. Upstream, the residential-side banks of Reach 4 consist of vertical concrete walls.

C. WILDLIFE

The Service has no records of federally listed, proposed, or candidate species in the vicinity of the project site (Appendix A). The New Jersey Natural Heritage Program found no records of State-listed or rare plants, animals, or natural communities within the project area (Appendix B). The Heritage Program reported foraging habitat for the State-listed (threatened) black-crowned night heron (*Nycticerax nycticorax*) and other colonial waterbirds within 0.25 mile, but this

foraging habitat does not extend into the project area. The New Jersey Department of Environmental Protection's (NJDEP) Landscape Project maps (Niles *et al.*, 2001) and rare plant grid show no records of State-listed or rare plants or animals in the project area.

Habitat conditions in the project area tend to limit wildlife to typical suburban species tolerant of noise and disturbance. Species observed in the project area include mourning dove (*Zenaida macroura*), northern cardinal (*Cardinalis cardinalis*), American robin (*Turdus migratorius*), and European starling (*Sturnus vulgaris*). Other bird species expected to occur in the area include American crow (*Corvus brachyrhynchos*), black-capped chickadee (*Parus atricapillus*), blue jay (*Cyanocitta cristata*), common grackle (*Quiscalus quiscula*), house finch (*Carpodacus mexicanus*), house sparrow (*Passer domesticus*), northern mockingbird (*Mimus polyglottos*), red-winged blackbird (*Agelaius phoeniceus*), tufted titmouse (*Parus bicolor*), and several common species of sparrows (Subfamily Emberizinae) and woodpeckers (Order Piciformes). Evidence was observed of deer (*Odocoileus virginianus*) and raccoon (*Procyon lotor*). Other mammal species likely present include gray squirrel (*Sciurus carolinensis*), opossum (*Didelphis virginiana*), field mice (*Peromyscus* spp.) and several common species of bats (Family Vespertilionidae). No reptile, amphibian, or fish species were observed.

The New Jersey Audubon Society's breeding bird atlas (Walsh *et al.*, 1999) lists 43 species known to breed in the atlas block that contains the project area streams. This atlas block also contains the western fork of the South Branch, which appears to offer wider riparian corridors in places compared to the eastern fork (Parkway Branch). Other than these riparian corridors, NJDEP Landscape Project mapping and aerial photography suggest little habitat for breeding birds within this atlas block; therefore, many of the 43 species likely breed along the project area streams. None of the 43 species are federally listed or candidate species, nor are they State-listed or State species of concern. One species, however, the wood thrush (*Hylocichla mustelina*), is a species of management concern to the Service within the Piedmont Bird Conservation Region, and within the Service's Northeastern Region (U.S. Fish and Wildlife Service, 2002). Wood thrushes nest in the understory of moist deciduous or mixed forests, especially near water, occasionally near human habitation (Erlich *et al.*, 1988; Walsh, *et al.*, 1999). Wood thrushes may use the project area, particularly where riparian corridors are wider along Reaches 2 and 3. Due to the narrow widths of habitats along streams in this atlas block, none of the 43 species are forest-interior nesting birds. However, the wooded stream banks of the project area may provide stopover habitats for forest-interior and other neotropical songbirds during migration. Because of its location and habitat conditions, the project area is unlikely to support significant numbers of shorebirds, raptors, or waterfowl during migration.

According to Corps staff, New Jersey Turnpike-Garden State Parkway Authority reported no fish present in the study area streams during a preliminary investigation (McClain, pers. comm., 2004). Although no sampling of the subject streams has been conducted, the New Jersey Division of Fish and Wildlife (NJDFW) indicated that minnow species (Umbridae) and American eel (*Anguilla rostrata*) are likely present, given the size, location, and characteristics of the South Branch and the unnamed tributary. Other fish species that may be present include sunfish (Centrarchidae), carp (Cyprinidae), pickerel (*Esox* sp.), killifish (Cyprinodontidae), and largemouth bass (*Micropterus salmoides*). The fish community would be expected to include

only species tolerant of water quality degraded by runoff from the surrounding development (Borriek, pers. comm., 2004). Project area streams are not identified by the NJDFW as trout-producing waters (Borriek, pers. comm., 2004), and the Rahway River drainage has no confirmed or reported anadromous fish spawning runs upstream of estuarine waters, which would include the project area (New Jersey Department of Environmental Protection, 2000).

V. PROJECT EFFECTS AND SERVICE RECOMMENDATIONS

A. SERVICE MITIGATION POLICY

The Service's views and recommendations on this project are guided by its Mitigation Policy (Federal Register, Vol. 46, No. 15, January 23, 1981). This policy reflects the goal that the most important fish and wildlife resources should receive priority in mitigation planning. The term "mitigation" is defined as: (a) avoiding a negative impact altogether by not taking a certain action or parts of an action; (b) minimizing negative impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the negative impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating negative impacts over time; and (e) compensating for negative impacts by replacing or providing substitute resources or habitats. The Service's Mitigation Policy provides different wildlife planning goals based upon the value of the habitat to be impacted. The Service views the streams and riparian corridor within the project area as providing medium wildlife habitat value. Therefore, the Service's planning goal is no-net-loss of habitat value, while minimizing loss of in-kind habitat value.

B. PERMANENT EFFECTS

Streambank stabilization affects many of the structural characteristics and functions of a stream, which can be divided into the following broad categories: (1) hydrologic balance; (2) sediment processes; (3) chemical processes; (4) morphologic processes; and (5) provision of habitat. Many of the impacts associated with erosion control measures are independent of the material used. Material-related impacts are generally associated with the habitat characteristics of the structure and the influence of the structure on riparian vegetation (Fischenich, 2003).

The proposed project would have minor effects on hydrologic balance, sediment processes, and chemical processes of the South Branch. Such effects would result primarily from reducing erosion in limited sections of the 2-mile stream segment. Reducing erosion in these areas will generally benefit water quality and wildlife resources by reducing sedimentation and turbidity in the streams. Opportunities exist for the Corps, with local support, to further improve water quality and stream conditions further by improving stormwater management in localized areas; Service recommendations are provided below.

Any bank stabilization technique is expected to affect morphologic stream processes by preventing lateral migration, and through affecting riparian succession (Fischenich, 2003). However, the existing development that surrounds the area largely precludes stream migration, and incremental effects of the project on lateral migration would be negligible. The primary effects of the project would be on riparian vegetation and wildlife habitat along the banks.

Wildlife resources may be positively or negatively affected, depending on the selected stabilization method(s) and bank revegetation plans. Accordingly, direct effects on riparian vegetation and wildlife habitat are the focus of the following Service recommendations.

Address the underlying causes of erosion. The Service recognizes that a full assessment of the causes of erosion, particularly land use patterns in the watershed, is beyond the Corps' authority and the scope of the proposed project. However, where specific features within project area streams are contributing to local erosion problems, the Service recommends that the Corps correct these structures in conjunction with bank stabilization. Specifically, the size, grade, design, condition, and maintenance regime of culverts and stormwater discharge pipes should be corrected where inadequate. In particular, the following structures appear to be contributing to local erosion:

- culvert under the GSP at the upstream end of Reach 1 (possibly a maintenance problem);
- culvert under the GSP/Route 1 highway loop in Reach 1;
- hanging discharge pipe within highway loop in Reach 1;
- discharge pipes near the school in Reach 2; and
- culvert at the upstream end of Reach 4.

The Service recognizes that correcting inadequacies associated with these structures goes beyond traditional bank stabilization. However, addressing these underlying causes of erosion (1) would improve water quality and in-stream habitat conditions, (2) may allow stabilization in the proposed areas with fewer or smaller structures and at a lower cost, and (3) may limit the need for stabilization of additional stream bank reaches in the future. As beneficiaries of the bank stabilization, the New Jersey Turnpike-Garden State Parkway Authority and the Menlo Park school should be encouraged to cooperate in efforts to upgrade these structures by providing access, in-kind services, and complimentary projects, such as installation or upgrade of detention basins to correct inadequate stormwater management.

Minimize structural stabilization and maximize vegetative stabilization. The Service recognizes that steep banks limit stabilization options in many sections of the project area. However, extensive grading to create more gradual slopes is not recommended, as this would entail substantial tree clearing and is precluded in many areas by infrastructure located close to the top of the existing banks.

The Service recommends against selecting a uniform solution for all stabilization areas, which could involve structures that are more extensive than necessary for some sites. Rather, the Service recommends that the Corps consider each stabilization area individually and select a design for each section of streambank that minimizes structural solutions. The Service recognizes that stability factors may necessitate a change from live cribwalls to a geogrid wall in some locations. However, the cribwall offers environmental advantages over the geogrid, primarily through organic, biodegradable building materials that will provide habitats and will more rapidly evolve to a purely vegetated condition. Therefore, the Service recommends that the cribwall design be retained where local conditions permit.

Allen and Leech (1997) describe a vegetative geogrid as "successive walls of several lifts of fabric reinforcement." These systems are sometimes also referred to as "fabric encapsulated soil."

Between the lifts are placed 5- to 10-foot-long live whips, often willow (*Salix* spp.). In a typical system, two layers of coconut fiber-based fabric provide both structural strength and resistance to piping (internal erosion within the bank) of fine material. The inner layer is a loose coconut fiber blanket held together by synthetic mesh netting and is used to trap fine particles and prevent piping. The outer layer is a strong, woven coir fabric to provide structural support. Sometimes, the latter fabric is substituted by stronger and more durable synthetic materials that are formed by a matrix of geosynthetic bands. The disadvantage of the latter materials, however, is that they are not very biodegradable. In their discussion of geogrids, Allen and Leech (1997) do not mention the "biodegradable black steel wire mesh facing unit" that is shown on the Corps proposed project plans. The Service recommends that the Corps evaluate geogrid wall systems that employ fabric only, as these building materials would biodegrade more quickly.

According to Allen and Leech (1997), a vegetated geogrid system can be used in the splash zone only, or extend further into the bank and possibly terrace zones. These authors indicate that there are no set guidelines regarding how far up the bank to place a revetment, except that it should be applied below the scour zone up to at least the level on the bank where water runs the majority of the year. As the project area banks are deeply incised, it is unlikely that water runs to the tops of the banks during most of the year. Therefore, whether using a cribwall or geogrid wall, the Service questions if the structural stabilization must extend to the tops of the banks as shown on plans. Where conditions permit, the Service recommends stabilizing the upper banks with vegetation only. The NJDEP has suggested that Longitudinal Peaked Stone Toe Protection (LPSTP) may reduce the need for structural stabilization further up the banks (Didun, pers. comm., 2004); the Service recommends that the Corps investigate this alternative. More information about LPSTP is provided in Appendix C (Derrick, pers. comm., 2004).

Where rip rap and other hard armor are proposed to stabilize outfall structures, the Service recommends that the Corps first pursue reconfiguration of these discharge pipes, as discussed above. A correctly designed and installed pipe may require less hard armor than the existing structures, particularly if accompanied by upgraded stormwater treatment (*i.e.*, proper detention basins on GSP and Menlo Park school property).

Prepare and implement a construction plan to protect existing riparian vegetation. The wooded riparian corridor along the South Branch provides some of the relatively scarce habitat in the region for migratory birds, small mammals, and other wildlife. Therefore, the Service recommends that the Corps design and implement the project to minimize tree clearing. Wherever possible, retain mature trees. In final engineering plans, include detailed references to which trees will be preserved and which, if any, must be removed. Clearly mark trees to be protected in the field, and discuss tree-felling avoidance with the contractor, prior to construction.

Select access routes and staging/storage areas outside wooded areas. In particular, plans show access routes through wooded areas in Reach 2, and in the downstream section of Reach 1 (between Route 1, the GSP, and the shopping center). Instead of these proposed access routes, the Service recommends accessing the downstream portion of Reach 1 via Route 1, and accessing Reach 2 via an existing unpaved road that connects the GSP, the upland field, and the school (via the concrete stream crossing proposed for removal). The Service recommends the use of orange fencing to delineate construction staging, storage, and access areas.

The Service recommends that the Corps remove stands of non-native vegetation (*e.g.*, common reed (*Phragmites australis*), tree of heaven (*Ailanthus altissima*), Japanese knotweed, bamboo) if encountered in or near construction areas. We also recommend that the Corps retain or replace woody debris within the streams and along the banks. The Service further recommends that the Corps avoid all work on the GSP side of Reach 3; this area contains the highest quality wildlife habitat in the project area, and likely contains some areas of wetlands.

Prepare and implement a planting plan. The probability for bioengineering to fail is higher when fewer species are planted and where growth stresses are greater. Bioengineering is more effective when plants native to the area are used. Plants that are growing along all parts of the streambank (lower, middle, and upper) should be identified and evaluated. Existing growing conditions and species should be emulated as much as possible. Exotic plants should not be used as these species may out-compete and replace native species. The entire streambank should be treated to furnish a maximum array of plants capable of providing proper ground cover and root penetration for erosion protection, wildlife habitat, water quality improvement, and other benefits (Allen and Leech, 1997).

The Service recommends that the Corps replant the entire bank face, and all areas along the tops of the banks that must be cleared for construction or to remove invasive species. We recommend a mix of native, shrubby, flood-tolerant species along the bank faces. Along the tops of the banks, the Service recommends a diverse assembly of native trees and shrubs that approximates the existing oak-dominated wooded cover type currently present in the area. Allen and Leech (1997) provide guidelines for plant acquisition, handling, and timing of planting. The Service recommends that that Corps prepare and implement a planting plan, and provide the plan for Service review prior to project implementation.

Prepare and implement a monitoring and adaptive management plan. Monitoring and maintenance must be a part of any bioengineering design (Allen and Leech, 1997). The Service recommends that the Corps develop and implement a plan to monitor the survival of planted vegetation, and take corrective actions if riparian vegetation does not develop as expected. Corrective actions may include replanting areas that fail, and removing invasive vegetation that may colonize the area. The Service requests the Corps to provide the monitoring plan for review prior to project implementation.

Seek opportunities for incidental environmental enhancements. In two particular locations, the Service recommends that the Corps work with partners to include environmental enhancements in the proposed project. In Reach 1, the Service recommends that the Corps work with Beth Israel Cemetery to stabilize an eroding ditch that drains a maintenance parking lot into the South Branch. This ditch is likely contributing sediment and non-point source pollution to the stream. The Service recommends stabilizing the ditch, and implementing stormwater management on the cemetery property.

In Reach 2, the Service recommends that the Corps work with municipal officials to enhance the abandoned field on the GSP side of the stream, across from Menlo Park school. The field is the

site of (likely illegal) trash dumping, and is probably dominated by non-native species. The Service recommends removing the trash and planting the field with native warm season grasses to enhance habitat for migratory birds and other wildlife. The enhanced field may also provide opportunities for environmental education. The Service's Partners for Fish and Wildlife Program may be able to provide assistance with such a project (information provided in Appendix D). The design and timing of the adjacent Corps stabilization project should be coordinated with efforts to improve the field.

C. TEMPORARY EFFECTS

Temporary adverse effects from the proposed project would primarily involve impacts to water quality from sediment and debris entering the streams. The Service recommends that the Corps implement best management practices for erosion and sediment control during construction to reduce any potential runoff, sedimentation, or turbidity into the streams. The New Jersey Soil Erosion and Sediment Control Act (N.J.A.C. 4:24-39 *et seq.*) requires a plan for erosion and sediment control for virtually all activities on non-agricultural land disturbing more than 5,000 square feet of surface area (New Jersey Department of Agriculture, 2004). The plan must be consistent with the Standards for Soil Erosion and Sediment Control in New Jersey (New Jersey State Soil Conservation Committee, 1999).

The Service concurs with the Corps' proposals to remove the large dual culvert from the stream Reach 3, and the concrete road-crossing from the stream in Reach 2. Particular care should be used in preventing sediment and debris from entering the stream during demolition of these structures. In particular, the Service recommends diverting the stream during removal of the large culvert structure. This culvert is covered with sediment and vegetation, including trees, and may be holding large amounts of sediment in place along the Gill Lane side bank of the stream. The Service recommends working "in the dry" to ensure that the culvert structure can be removed and the bank stabilized and revegetated without a large release of sediment. The stream may be diverted using small cofferdams, or two sets of wooden, framed, wing walls connected to a flexible, bag-like PVC tube used to convey flowing water around a work area. A PVC tube diversion is proposed by the Corps on the Upper Passaic River at Long Hill Township Flood Damage Reduction and Ecosystem Restoration Project (Walsh, 2003); the Long Hill project may provide a model for implementing this type of stream diversion.

The NJDEP normally recommends a seasonal restriction on sediment-generating activities along streams during May and June to protect warm water fish spawning. This restriction may be waived with adequate sediment controls and spring planting of bank-stabilizing vegetation (Didun, pers. comm., 2004). The Service recommends that the Corps implement the seasonal restriction and/or spring planting to protect warm water fish, and that the Corps contact the NJDEP Land Use Regulation Program for information regarding the State permitting process under the New Jersey Flood Hazard Area Control Act (N.J.S.A. 58:16A) and the Freshwater Wetlands Protection Act (N.J.S.A. 13:9B).

VI. CONCLUSIONS AND SUMMARY OF RECOMMENDATIONS

The South Branch of the Rahway River Emergency Streambank Stabilization Project is expected to have minor effects on hydrologic balance, sediment processes, and chemical processes of approximately 2.0 miles of streams, primarily by reducing erosion in these areas. The Service anticipates those effects will benefit water quality and wildlife resources by reducing sedimentation and turbidity in the streams. The Service has provided recommendations for the Corps to further improve water quality and stream conditions by improving stormwater management in certain localized areas. The Service anticipates the project would have negligible effects on morphologic stream processes (*i.e.*, prevention of lateral migration).

The primary effects of the project would be on riparian vegetation and wildlife habitat on the banks of project area streams. These effects may be beneficial or adverse to wildlife resources, depending on the selected stabilization method(s) and bank revegetation plans. Accordingly, direct effects on riparian vegetation and wildlife habitat are the focus of the Service's recommendations for the project. With proper sediment and erosion control, temporary effects of the project should be minimal.

The Service recommends the following measures to further reduce and mitigate project effects to wildlife resources.

1. Correct the size, grade, design, condition, and maintenance regime of culverts and stormwater discharge pipes where such structures are causing local erosion.

2. Encourage the New Jersey Turnpike-Garden State Parkway Authority and the Menlo Park school to cooperate in any efforts to upgrade culverts and stormwater discharge pipes, and to install or upgrade stormwater management facilities on their properties.

3. Consider each stabilization area individually and select a design for each location that minimizes structural solutions.

4. Retain the cribwall design over the geogrid wall where local conditions permit.

5. Evaluate geogrid wall systems that employ fabric only.

6. Stabilize the upper banks with vegetation only, where local conditions permit.

7. Determine if Longitudinal Peaked Stone Toe Protection (LPSTP) would reduce the need for structural stabilization further up the banks.

8. Minimize tree clearing, and wherever possible, retain mature trees. In final engineering plans, include detailed references to which trees will be preserved and which, if any, must be removed. Clearly mark trees to be protected in the field and discuss tree-felling avoidance with the contractor prior to construction.

9. Select access routes and staging/storage areas outside wooded areas. In particular, re-locate access routes in Reach 2 and the downstream section of Reach 1. Delineate staging, storage, and access areas with orange fencing.

10. Remove stands of non-native vegetation if encountered in or near construction areas.

11. Retain or replace woody debris within the streams and along the banks.

12. Avoid all work on the GSP side of Reach 3; this area contains the highest quality wildlife habitat in the project area and likely contains wetlands.

13. Replant the entire bank face, and all areas along the tops of banks that are cleared for construction or the removal of invasive species. Along the bank faces, plant a mix of native, shrubby, flood-tolerant species. Along the tops of the banks, plant a diverse assembly of native trees and shrubs that approximates the existing oak-dominated wooded cover type currently present in the area.

14. Prepare and implement a planting plan, and provide the plan for Service review prior to project implementation.

15. Develop and implement a plan to monitor the survival of planted vegetation, and take corrective actions if riparian vegetation does not develop as expected. Corrective actions may include replanting areas that fail and removing invasive vegetation that may colonize the area. Provide the plan for Service review prior to project implementation.

16. In Reach 1, work with Beth Israel Cemetery to stabilize an eroding ditch that drains a maintenance parking lot into the South Branch, and implement stormwater management on the cemetery property.

17. In Reach 2, work with municipal officials and the Service's Partners for Fish and Wildlife Program to enhance the abandoned field on the GSP side of the stream, across from Menlo Park school. Remove trash and plant the field with native warm season grasses. Coordinate any field enhancement plans with the adjacent bank stabilization efforts.

18. Implement best management practices for erosion and sediment control during construction to reduce any potential runoff, sedimentation, or turbidity into the streams (in accordance with the New Jersey Soil Erosion and Sediment Control Act and the Standards for Soil Erosion and Sediment Control in New Jersey).

19. Divert the stream in Reach 3 during demolition of the large dual culvert structure.

20. Implement a May and June seasonal restriction and/or spring planting to protect spawning of warm water fish.

21. Contact the NJDEP Land Use Regulation Program regarding State permitting requirements.

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B. PERSONAL COMMUNICATIONS

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APPENDIX A

Federally Listed Endangered and Threatened Species and Candidate Species in New Jersey

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN NEW JERSEY

An **ENDANGERED** species is any species that is in danger of extinction throughout all or a significant portion of its range.

A **THREATENED** species is any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

	COMMON NAME	SCIENTIFIC NAME	STATUS
FISHES	**Shortnose sturgeon***	*Acipenser brevirostrum*	E
REPTILES	**Bog turtle**	*Clemmys muhlenbergii*	T
	Atlantic Ridley turtle*	*Lepidochelys kempii*	E
	Green turtle*	*Chelonia mydas*	T
	Hawksbill turtle*	*Eretmochelys imbricata*	E
	Leatherback turtle*	*Dermochelys coriacea*	E
	Loggerhead turtle*	*Caretta caretta*	T
BIRDS	**Bald eagle**	*Haliaeetus leucocephalus*	T
	Piping plover	*Charadrius melodus*	T
	Roseate tern	*Sterna dougallii dougallii*	E
MAMMALS	**Eastern cougar**	*Felis concolor couguar*	E+
	Indiana bat	*Myotis sodalis*	E
	Gray wolf	*Canis lupus*	E+
	Delmarva fox squirrel	*Sciurus niger cinereus*	E+
	Blue whale*	*Balaenoptera musculus*	E
	Finback whale*	*Balaenoptera physalus*	E
	Humpback whale*	*Megaptera novaeangliae*	E
	Right whale*	*Balaena glacialis*	E
	Sei whale*	*Balaenoptera borealis*	E
	Sperm whale*	*Physeter macrocephalus*	E

	COMMON NAME	SCIENTIFIC NAME	STATUS
INVERTEBRATES	**Dwarf wedgemussel**	*Alasmidonta heterodon*	E
	Northeastern beach tiger beetle	*Cicindela dorsalis dorsalis*	T
	Mitchell saytr butterfly	*Neonympha m. mitchellii*	E+
	American burying beetle	*Nicrophorus americanus*	E+
PLANTS	**Small whorled pogonia**	*Isotria medeoloides*	T
	Swamp pink	*Helonias bullata*	T
	Knieskern's beaked-rush	*Rhynchospora knieskernii*	T
	American chaffseed	*Schwalbea americana*	E
	Sensitive joint-vetch	*Aeschynomene virginica*	T
	Seabeach amaranth	*Amaranthus pumilus*	T

STATUS:			
E	endangered species	PE	proposed endangered
T	threatened species	PT	proposed threatened
+	presumed extirpated**		

* Except for sea turtle nesting habitat, principal responsibility for these species is vested with the National Marine Fisheries Service.

** Current records indicate the species does not presently occur in New Jersey, although the species did occur in the State historically.

Note: for a complete listing of Endangered and Threatened Wildlife and Plants, refer to 50 CFR 17.11 and 17.12.

For further information, please contact:

U.S. Fish and Wildlife Service
New Jersey Field Office
927 N. Main Street, Building D
Pleasantville, New Jersey 08232
Phone: (609) 646-9310
Fax: (609) 646-0352

Revised 12/06/00

FEDERAL CANDIDATE SPECIES IN NEW JERSEY

CANDIDATE SPECIES are species that appear to warrant consideration for addition to the federal List of Endangered and Threatened Wildlife and Plants. Although these species receive no substantive or procedural protection under the Endangered Species Act, the U.S. Fish and Wildlife Service encourages federal agencies and other planners to give consideration to these species in the environmental planning process.

SPECIES	SCIENTIFIC NAME
Bog asphodel	***Narthecium americanum***
Hirst's panic grass	***Panicum hirstii***

Note: For complete listings of taxa under review as candidate species, refer to Federal Register Vol. 64, No. 205, October 25, 1999 (Endangered and Threatened Wildlife and Plants; Review of Plant and Animal Taxa that are Candidates for Listing as Endangered or Threatened Species).

Revised 11/99

APPENDIX B

State-listed Endangered and Threatened Species and Species of Concern in New Jersey; and New Jersey Natural Heritage Program Rare Species Information

New Jersey Division of Fish and Wildlife

Conserve Wildlife

New Jersey's Endangered and Threatened Wildlife

Endangered Species are those whose prospects for survival in New Jersey are in immediate danger because of a loss or change in habitat, over-exploitation, predation, competition, disease, disturbance or contamination. Assistance is needed to prevent future extinction in New Jersey.

Threatened Species are those who may become endangered if conditions surrounding them begin to or continue to deteriorate.

Species names link to PDF documents containing identification, habitat, and status and conservation information. Use the Adobe Acrobat Reader to view and print these documents. The Reader is available free from Adobe's Web site.

BIRDS			
Endangered		**Threatened**	
Bittern, American	*Botaurus lentiginosos* BR	Bobolink	*Dolichonyx oryzivorus* BR
Eagle, bald	*Haliaeetus leucocephalus* BR **	Eagle, bald	*Haliaeetus leucocephalus* NB **
Falcon, peregrine	*Falco peregrinus*	Hawk, Cooper's	*Accipiter cooperii*
Goshawk, northern	*Accipiter gentilis* BR	Hawk, red-shouldered	*Buteo lineatus* NB
Grebe, pied-billed	*Podilymbus podiceps**	Night-heron, black-crowned	*Nycticorax nycticorax* BR
Harrier, northern	*Circus cyaneus* BR	Night-heron, yellow-crowned	*Nyctanassa violaceus*
Hawk, red-shouldered	*Buteo lineatus* BR	Knot, red	*Calidris canutus* BR
Owl, short-eared	*Asio flammeus* BR	Osprey	*Pandion haliaetus* BR
Plover, piping	*Charadrius melodus***	Owl, barred	*Strix varia*
Sandpiper, upland	*Batramia longicauda*	Owl, long-eared	*Asio otus*
Shrike, loggerhead	*Lanius ludovicianus*	Rail, black	*Laterallus jamaicensis*
Skimmer, black	*Rynchops niger* BR	Skimmer, black	*Rynchops niger* NB
Sparrow, Henslow's	*Ammodramus henslowii*	Sparrow, grasshopper	*Ammodramus savannarum* BR
Sparrow, vesper	*Pooecetes gramineus* BR	Sparrow, Savannah	*Passerculus sandwichensis* BR
Tern, least	*Sterna antillarum*	Sparrow, vesper	*Pooecetes gramineus* NB
Tern, roseate	*Sterna dougallii***	Woodpecker, red-headed	*Melanerpes erythrocephalus*
Wren, sedge	*Cistothorus platensis*		

**Federally endangered or threatened

BR - Breeding population only; NB - non-breeding population only

REPTILES			
Endangered		**Threatened**	
Rattlesnake, timber	*Crotalus h. horridus*	Snake, northern pine	*Pituophis m. melanoleucus*
Snake, corn	*Elaphe g. guttata*	Turtle, Atlantic green	*Chelonia mydas***
Snake, queen	*Regina septemvittata*	Turtle, wood	*Clemmys insculpta*
Turtle, bog	*Clemmys muhlenbergii***		
Atlantic hawksbill	*Eretmochelys imbricata***		
Atlantic leatherback	*Dermochelys coriacea***		
Atlantic loggerhead	*Caretta caretta***		
Atlantic Ridley	*Lepidochelys kempi***		
**Federally endangered or threatened			

AMPHIBIANS			
Endangered		**Threatened**	
Salamander, blue-spotted	*Ambystoma laterale*	Salamander, eastern mud	*Pseudotriton montanus*
Salamander, eastern tiger	*Ambystoma tigrinum*	Salamander, long-tailed	*Eurycea longicauda*
Treefrog, southern gray	*Hyla chrysocelis*	Treefrog, pine barrens	*Hyla andersonii*

INVERTEBRATES			
Endangered		**Threatened**	
Beetle, American burying	*Nicrophorus mericanus***	Elfin, frosted (butterfly)	*Callophrys irus*
eetle, northeastern beach tiger	*Cincindela d. dorsalis***	Floater, triangle (mussel)	*Alasmidonta undulata*
opper, bronze	*Lycaena hyllus*	Fritillary, silver-bordered (butterfly)	*Bolaria selene myrina*
Floater, brook (mussel)	*Alasmidonta varicosa*	Lampmussel, eastern (mussel)	*Lampsilis radiata*
loater, green (mussel)	*Lasmigona subviridis*	Lampmussel, yellow (mussel)	*Lampsilis cariosa*
Satyr, Mitchell's (butterfly)	*Neonympha m. mitchellii***	Mucket, tidewater (mussel)	*Leptodea ochracea*

Skipper, arogos (butterfly)	*Atrytone arogos arogos*	Pondmussel, eastern (mussel)	*Ligumia nasuta*
Skipper, Appalachian grizzled (butterfly)	*Pyrgus wyandot*	White, checkered (butterfly)	*Pontia protodice*
Wedgemussel, dwarf	*Alasmidonta heterodon***		
**Federally endangered or threatened			

MAMMALS	
Endangered	
Bat, Indiana	*Myotis sodalis***
Bobcat	*Lynx rufus*
Whale, black right	*Balaena glacialis***
Whale, blue	*Balaenoptera musculus***
Whale, fin	*Balaenoptera physalus***
Whale, humpback	*Megaptera novaeangliae***
Whale, sei	*Balaenoptera borealis***
Whale,sperm	*Physeter macrocephalus***
Woodrat, Allegheny	*Neotoma floridana magister*
**Federally Endangered	

FISH	
Endangered	
Sturgeon, shortnose	*Acipenser brevirostrum***
**Federally Endangered	

List updated3/11/04

The lists of New Jersey's endangered and nongame wildlife species are maintained by the DEP's Division of Fish and Wildlife's Endangered and Nongame Species Program. These lists are used to determine protection and management actions necessary to ensure the survival of the state's endangered and nongame wildlife. This work is made possible through voluntary contributions received through Check-off donations to the Endangered Wildlife Conservation Fund on the New Jersey State Income Tax Form, the sale of Conserve Wildlife License Plates, and donations. For more information about the Endangered and Nongame Species Program or to report a sighting of endangered or threatened wildlife, contact the Endangered and Nongame Species, NJ Division of Fish and Wildlife, P.O. Box 400, Trenton, NJ 08625-0400, or call 609-292-9400.

State of New Jersey

mes E. McGreevey
Governor

Department of Environmental Protection
Division of Parks and Forestry
Office of Natural Lands Management
Natural Heritage Program
P.O. Box 404
Trenton, NJ 08625-0404
Tel. #609-984-1339
Fax. #609-984-1427

Bradley M. Campbell
Commissioner

May 24, 2004

Wendy Walsh
U.S. Fish and Wildlife Service, New Jersey Field Office
927 North Main Street, Building D
Pleasantville, NJ 08232-1454

Re: U.S. Army Corps of Engineers, South Branch Rahway River Emergency Streambank Stabilization Project, Woodbridge

Dear Ms. Walsh:

Thank you for your data reqnest regarding rare species information for the above referenced project site in Woodbridge Township, Middlesex County.

Searches of the Natural Heritage Database and the Landscape Project (Version 2) are based on a representation of the boundaries of your project site in our Geographic Information System (GIS). We make every effort to accurately transfer your project bounds from the topographic map(s) submitted with the Request for Data into our Geographic Information System. We do not typically verify that your project bounds are accurate, or check them against other sources.

Neither the Natural Heritage Database nor the Landscape Projecr has records for any rare wildlife species on rhe referenced site.

We have also checked the Natural Heritage Database and the Landscape Project habitat mapping for occurrences of any rare wildlife species or wildlife habitat within 1/4 mile of the referenced site. Please see the table below for species list and conservation status.

Species within 1/4 mile of referenced site.

Common Name	Scientific Name	Federal Status	State Status	Grank	Srank
black-crowned night-heron foraging habitat	*Nycticorax nycticorax*		T/S	G5	S3B,S4N
colonial waterbird foraging habitat					

We have also checked the Natural Heritage Database for occurrences of rare plant species or natural communities. The Natural Heritage Data Base does not have auy records for rare plants or natural communities on or within 1/4 mile of the site.

Attached is a list of rare species and natural communities that have been documented from Middlesex County. If suitable habitat is present at the project site, these species have potential to be present.

Status and rank codes used in the tables and lists are defined in the attached EXPLANATION OF CODES USED IN NATURAL HERITAGE REPORTS.

If you have questions concerning the wildlife records or wildlife species mentioned in this response, we recommend that you visit the interactive I-Map-NJ website at the following URL, http://www.state.nj.us/dep/gis/imapnj/imapnj.htm or contact the Division of Fish and Wildlife, Endangered and Nongame Species Program.

PLEASE SEE THE ATTACHED 'CAUTIONS AND RESTRICTIONS ON NHP DATA'.

Thank you for consultiug the Natural Heritage Program. The attached invoice details the payment due for processing this data request. Feel free to contact us again regarding any future data requests.

Sincerely,

Herbert A. Lord

Herbert A. Lord
Data Request Specialist

cc: Robert J. Cartica
Lawrence Niles
NHP File No. 04-4007453

CAUTIONS AND RESTRICTIONS ON NATURAL HERITAGE DATA

The quantity and quality of data collected by the Natural Heritage Program is dependent on the research and observations of many individuals and organizations. Not all of this information is the result of comprehensive or site-specific field surveys. Some natural areas in New Jersey have never been thoroughly surveyed. As a result, new locations for plant and animal species are continuously added to the database. Since data acquisition is a dynamic, ongoing process, the Natural Heritage Program cannot provide a definitive statement on the presence, absence, or condition of biological elements in any part of New Jersey. Information supplied by the Natural Heritage Program summarizes existing data known to the program at the time of the request regarding the biological elements or locations in question. They should never be regarded as final statements on the elements or areas being considered, nor should they be substituted for on-site surveys required for environmental assessments. The attached data is provided as one source of information to assist others in the preservation of natural diversity.

This office cannot provide a letter of interpretation or a statement addressing the classification of wetlands as defined by the Freshwater Wetlands Act. Requests for such determination should be sent to the DEP Land Use Regulation Program, P.O. Box 401, Trenton, NJ 08625-0401.

The Landscape Project was developed by the Division of Fish & Wildlife, Endangered and Nongame Species Program to map critical habitat for rare animal species. Some of the rare species data in the Landscape Project is in the Natural Heritage Database, while other records were obtained from other sources. Natural Heritage Database response letters will list all species (if any) found during a search of the Landscape Project. However, any reports that are included with the response letter will only reference specific records if they are in the Natural Heritage Database. This office cannot answer any inquiries about the Landscape Project. All questions should be directed to the DEP Division of Fish and Wildlife, Endangered and Nongame Species Program, P.O. Box 400, Trenton, NJ 08625-0400.

This cautions and restrictions notice must be included whenever information provided by the Natural Heritage Database is published.

NJ Department of Environmental Protection
Division of Parks and Forestry
Natural Lands Management

EXPLANATIONS OF CODES USED IN NATURAL HERITAGE REPORTS

FEDERAL STATUS CODES

The following U.S. Fish and Wildlife Service categories and their definitions of endangered and threatened plants and animals have been modified from the U.S. Fish and Wildlife Service (F.R. Vol. 50 No. 188; Vol. 61, No. 40; F.R. 50 CFR Part 17). Federal Status codes reported for species follow the most recent listing.

LE	Taxa formally listed as endangered.
LT	Taxa formally listed as threatened.
PE	Taxa already proposed to be formally listed as endangered.
PT	Taxa already proposed to be formally listed as threatened.
C	Taxa for which the Service currently has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species.
S/A	Similarity of appearance species.

STATE STATUS CODES

Two animal lists provide state status codes after the Endangered and Nongame Species Conservation Act of 1973 (NSSA 23:2A-13 et. seq.): the list of endangered species (N.J.A.C. 7:25-4.13) and the list defining status of indigenous, nongame wildlife species of New Jersey (N.J.A.C. 7:25-4.17(a)). The status of animal species is determined by the Nongame and Endangered Species Program (ENSP). The state status codes and definitions provided reflect the most recent lists that were revised in the New Jersey Register, Monday, June 3, 1991.

D	Declining species-a species which has exhibited a continued decline in population numbers over the years.
E	Endangered species-an endangered species is one whose prospects for survival within the state are in immediate danger due to one or many factors - a loss of habitat, over exploitation, predation, competition, disease. An endangered species requires immediate assistance or extinction will probably follow.
EX	Extirpated species-a species that formerly occurred in New Jersey, but is not now known to exist within the state.
I	Introduced species-a species not native to New Jersey that could not have established itself here without the assistance of man.
INC	Increasing species-a species whose population has exhibited a significant increase, beyond the normal range of its life cycle, over a long term period.
T	Threatened species-a species that may become endangered if conditions surrounding the species begin to or continue to deteriorate.
P	Peripheral species-a species whose occurrence in New Jersey is at the extreme edge of its present natural range.
S	Stable species-a species whose population is not undergoing any long-term increase/decrease within its natural cycle.
U	Undetermined species-a species about which there is not enough information available to determine the status.

Status for animals separated by a slash(/) indicate a duel status. First status refers to the state breeding population, and the second status refers to the migratory or winter population.

Plant taxa listed as endangered are from New Jersey's official Endangered Plant Species List N.J.S.A. 13:1B-15.151 et seq.

E Native New Jersey plant species whose survival in the State or nation is in jeopardy.

REGIONAL STATUS CODES FOR PLANTS

LP Indicates taxa listed by the Pinelands Commission as endangered or threatened within their legal jurisdiction. Not all species currently tracked by the Pinelands Commission are tracked by the Natural Heritage Program. A complete list of endangered and threatened Pineland species is included in the New Jersey Pinelands Comprehensive Management Plan.

EXPLANATION OF GLOBAL AND STATE ELEMENT RANKS

The Nature Conservancy has developed a ranking system for use in identifying elements (rare species and natural communities) of natural diversity most endangered with extinction. Each element is ranked according to its global, national, and state (or subnational in other countries) rarity. These ranks are used to prioritize conservation work so that the most endangered elements receive attention first. Definitions for element ranks are after The Nature Conservancy (1982: Chapter 4, 4.1-1 through 4.4.1.3-3).

GLOBAL ELEMENT RANKS

G1 Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.

G2 Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.

G3 Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout it's range; with the number of occurrences in the range of 21 to 100.

G4 Apparently secure globally; although it may be quite rare in parts of its range, especially at the periphery.

G5 Demonstrably secure globally; although it may be quite rare in parts of its range, especially at the periphery.

GH Of historical occurrence throughout its range i.e., formerly part of the established biota, with the expectation that it may be rediscovered.

GU Possibly in peril range-wide but status uncertain; more information needed.

GX Believed to be extinct throughout range (e.g., passenger pigeon) with virtually no likelihood that it will be rediscovered.

G? Species has not yet been ranked.

STATE ELEMENT RANKS

S1 Critically imperiled in New Jersey because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres). Elements so ranked are often restricted to very specialized conditions or habitats and/or restricted to an extremely small geographical area of the state. Also included are elements which were formerly more abundant, but because of habitat destruction or some other critical factor of its biology, they have been demonstrably reduced in abundance. In essence, these are elements for which, even with intensive searching, sizable additional occurrences are unlikely to be discovered.

S2 Imperiled in New Jersey because of rarity (6 to 20 occurrences). Historically many of these elements may have been more frequent but are now known from very few extant occurrences, primarily because of habitat destruction. Diligent searching may yield additional occurrences.

S3 Rare in state with 21 to 100 occurrences (plant species in this category have only 21 to 50 occurrences). Includes elements which are widely distributed in the state but with small populations/acreage or elements with restricted distribution, but locally abundant. Not yet imperiled in state but may soon be if current trends continue. Searching often yields additional occurrences.

S4 Apparently secure in state, with many occurrences.

S5 Demonstrably secure in state and essentially ineradicable under present conditions.

SA Accidental in state, including species (usually birds or butterflies) recorded once or twice or only at very great intervals, hundreds or even thousands of miles outside their usual range; a few of these species may even have bred on the one or two occasions they were recorded; examples include European strays or western birds on the East Coast and vice-versa.

SE Elements that are clearly exotic in New Jersey including those taxa not native to North America (introduced taxa) or taxa deliberately or accidentally introduced into the State from other parts of North America (adventive taxa). Taxa ranked SE are not a conservation priority (viable introduced occurrences of G1 or G2 elements may be exceptions).

SH Elements of historical occurrence in New Jersey. Despite some searching of historical occurrences and/or potential habitat, no extant occurrences are known. Since not all of the historical occurrences have been field surveyed, and unsearched potential habitat remains, historically ranked taxa are considered possibly extant, and remain a conservation priority for continued field work.

SP Element has potential to occur in New Jersey, but no occurrences have been reported.

SR Elements reported from New Jersey, but without persuasive documentation which would provide a basis for either accepting or rejecting the report. In some instances documentation may exist, but as of yet, its source or location has not been determined.

SRF Elements erroneously reported from New Jersey, but this error persists in the literature.

SU Elements believed to be in peril but the degree of rarity uncertain. Also included are rare taxa of uncertain taxonomical standing. More information is needed to resolve rank.

SX Elements that have been determined or are presumed to be extirpated from New Jersey. All historical occurrences have been searched and a reasonable search of potential habitat has been completed. Extirpated taxa are not a current conservation priority.

SXC Elements presumed extirpated from New Jersey, but native populations collected from the wild exist in cultivation.

SZ Not of practical conservation concern in New Jersey, because there are no definable occurrences, although the taxon is native and appears regularly in the state. An SZ rank will generally be used for long distance migrants whose occurrences during their migrations are too irregular (in terms of repeated visitation to the same locations), transitory, and dispersed to be reliably identified, mapped and protected. In other words, the migrant regularly passes through the state, but enduring, mappable element occurrences cannot be defined.

Typically, the SZ rank applies to a non-breeding population (N) in the state - for example, birds on migration. An SZ rank may in a few instances also apply to a breeding population (B), for example certain lepidoptera which regularly die out every year with no significant return migration.

Although the SZ rank typically applies to migrants, it should not be used indiscriminately. Just because a species is on migration does not mean it receives an SZ rank. SZ will only apply when the migrants occur in an irregular, transitory and dispersed manner.

B Refers to the breeding population of the element in the state.

N Refers to the non-breeding population of the element in the state.

T Element ranks containing a "T" indicate that the infraspecific taxon is being ranked differently than the full species. For example *Stachys palustris* var. *homotricha* is ranked "G5T? SH" meaning the full species is globally secure but the global rarity of the var. *homotricha* has not been determined; in New Jersey the variety is ranked historic.

Q Elements containing a "Q" in the global portion of its rank indicates that the taxon is of questionable, or uncertain taxonomical standing, e.g., some authors regard it as a full species, while others treat it at the subspecific level.

.1 Elements documented from a single location.

Note: To express uncertainty, the most likely rank is assigned and a question mark added (e.g., G2?). A range is indicated by combining two ranks (e.g., G1G2, S1S3).

IDENTIFICATION CODES

These codes refer to whether the identification of the species or community has been checked by a reliable individual and is indicative of significant habitat.

Y Identification has been verified and is indicative of significant habitat.

BLANK Identification has not been verified but there is no reason to believe it is not indicative of significant habitat.

? Either it has not been determined if the record is indicative of significant habitat or the identification of the species or community may be confusing or disputed.

27 JUN 2002

MIDDLESEX COUNTY

RARE SPECIES AND NATURAL COMMUNITIES PRESENTLY RECORDED IN

THE NEW JERSEY NATURAL HERITAGE DATABASE

NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS	REGIONAL STATUS	GRANK	SRANK
*** Vertebrates						
AMMODRAMUS HENSLOWII	HENSLOW'S SPARROW		E		G4	S1B
AMMODRAMUS SAVANNARUM	GRASSHOPPER SPARROW		T/S		G5	S2B
ASIO OTUS	LONG-EARED OWL		T/T		G5	S2B,S2N
BARTRAMIA LONGICAUDA	UPLAND SANDPIPER		E		G5	S1B
CIRCUS CYANEUS	NORTHERN HARRIER		E/U		G5	S1B,S3N
CLEMMYE INSCULPTA	WOOD TURTLE		T		G4	S3
CLEMMYS MUHLENBERGII	BOG TURTLE	LT	E		G3	S2
DOLICHONYX ORYZIVORUS	BOBOLINK		T/T		G5	S2B
FALCO PEREGRINUS	PEREGRINE FALCON		E		G4	S1B,S?N
HYLA ANDERSONII	PINE BARRENS TREEFROG		E		G4	S3
IXOBRYCHUS EXILIS	LEAST BITTERN		D/S		G5	S3B
LANIUS LUDOVICIANUS MIGRANS	MIGRANT LOGGERHEAD SHRIKE		E		G4T3Q	S1B,S1N
NYCTANASSA VIOLACEA	YELLOW-CROWNED NIGHT-HERON		T/T		G5	S2B
PASSERCULUS SANDWICHENSIS	SAVANNAH SPARROW		T/T		G5	S2B,S4N
PODILYMBUS PODICEPS	PIED-BILLED GREBE		E/S		G5	S1B,S3N
*** Invertebrates						
AESHNA CLEPSYDRA	MOTTLED DARNER				G4	S2S3
ALASMIDONTA UNDULATA	TRIANGLE FLOATER		T		G4	S3
ANAX LONGIPES	COMET DARNER				G5	S2S3
BOLORIA SELENE MYRINA	A SILVER-BORDERED FRITILLARY		T		G5T5	S2
CALLOPHRYS IRUS	FROSTED ELFIN		T		G3	S2S3
CALLOPHRYS POLIOS	HOARY ELFIN				G5	S3
CELITHEMIS MARTHA	MARTHA'S PENNANT				G4	S3S4
ENALLAGMA BASIDENS	DOUBLE-STRIPED BLUET				G5	S3
ENALLAGMA PICTUM	SCARLET BLUET				G3	S3
ERYNNIS PERSIUS PERSIUS	A PERSIUS DUSKY WING				G5T2T3	SH
HESPERIA LEONARDUS	LEONARD'S SKIPPER				G4	S2
LASMIGONA SUBVIRIDIS	GREEN FLOATER		E		G3	S1

MIDDLESEX COUNTY

RARE SPECIES AND NATURAL COMMUNITIES PRESENTLY RECORDED IN

THE NEW JERSEY NATURAL HERITAGE DATABASE

NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS	REGIONAL STATUS	GRANK	SRANK
LESTES EURINUS	AMBER-WINGED SPREADWING				G4	S2
METARRANTHIS PILOSARIA	COASTAL BOG METARRANTHIS				G3G4	S3S4
PAPAIPEMA NECOPINA	SUNFLOWER BORER MOTH				G4?	SH
PONTIA PROTODICE	CHECKERED WHITE		T		G4	S1
SATYRODES EURYDICE	EYED BROWN				G4	S1
SPEYERIA APHRODITE	APHRODITE FRITILLARY				G5	S2S3
SPEYERIA IDALIA	REGAL FRITILLARY				G3	SH
SYMPETRUM AMBIGUUM	BLUE-FACED MEADOWHAWK				G5	S2
*** Vascular plants						
AGALINIS AURICULATA	EAR-LEAF FALSE FOXGLOVE				G3	SX
AGASTACHE NEPETOIDES	YELLOW GIANT-HYSSOP				G5	S2
ARTEMISIA CAMPESTRIS SSP CAUDATA	BEACH WORMWOOD				G5T5	S2
ASCLEPIAS RUBRA	RED MILKWEED			LP	G4G5	S2
ASCLEPIAS VERTICILLATA	WHORLED MILKWEED				G5	S2
ASTER RADULA	LOW ROUGH ASTER		E		G5	S1
BIDENS BIDENTOIDES	ESTUARY BURR-MARIGOLD				G3	S2
BIDENS EATONII	EATON'S BEGGAR-TICKS		E		G2	S1.1
CALAMOVILFA BREVIPILIS	PINE BARREN REEDGRASS			LP	G4	S4
CAREX BARRATTII	BARRATT'S SEDGE			LP	G4	S4
CAREX LOUISIANICA	LOUISIANA SEDGE		E		G5	S1
CAREX POLYMORPHA	VARIABLE SEDGE		E		G3	S1
CAREX UTRICULATA	BOTTLE-SHAPED SEDGE				G5	S2
CAREX WILLDENOWII VAR WILLDENOWII	WILLDENOW'S SEDGE				G5T5	S2
CRATAEGUS CALPODENDRON	PEAR HAWTHORN		E		G5	S1
CYPERUS LANCASTRIENSIS	LANCASTER FLAT SEDGE		E		G5	S1
DRABA REPTANS	CAROLINA WHITLOW-GRASS		E		G5	SH
ELATINE AMERICANA	AMERICAN WATERWORT				G4	S2

MIDDLESEX COUNTY

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NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS	REGIONAL STATUS	GRANK	SRANK
EUPATORIUM ALTISSIMUM	TALL BONESET				G5	S2
GENTIANA SAPONARIA VAR SAPONARIA	SOAPWORT GENTIAN				G5T?	S3
HELONIAS BULLATA	SWAMP-PINK	LT	E	LP	G3	S3
HOTTONIA INFLATA	FEATHERFOIL		E		G4	S1
HYDROCOTYLE RANUNCULOIDES	FLOATING MARSH-PENNYWORT		E		G5	S1
ISOETES RIPARIA VAR RIPARIA	SHORE QUILLWORT				G5?T5?Q	S3
LATHYRUS OCHROLEUCUS	CREAM VETCHLING		E		G4G5	SH
LIATRIS SCARIOSA VAR NOVAE-ANGLIAE	NORTHERN BLAZING-STAR		E		G5?T3	SH
LISTERA AUSTRALIS	SOUTHERN TWAYBLADE			LP	G4	S2
LYGODIUM PALMATUM	CLIMBING FERN			LP	G4	S2
LYSIMACHIA HYBRIDA	LOWLAND LOOSESTRIFE				G5	S3
MELANTHIUM VIRGINICUM	VIRGINIA BUNCHFLOWER		E		G5	S1
MICRANTHEMUM MICRANTHEMOIDES	NUTTALL'S MUDWORT		E		GH	SH
MIMULUS ALATUS	WINGED MONKEY-FLOWER				G5	S3
MYRIOPHYLLUM TENELLUM	SLENDER WATER-MILFOIL		E		G5	S1
MYRIOPHYLLUM VERTICILLATUM	WHORLED WATER-MILFOIL		E		G5	SH
PHORADENDRON LEUCARPUM	AMERICAN MISTLETOE			LP	G5	S2
PLANTAGO MARITIMA VAR JUNCOIDES	SEASIDE PLANTAIN				G5T5	S2
PLATANTHERA FLAVA VAR FLAVA	SOUTHERN REIN ORCHID		E		G4T4?Q	S1
PLATANTHERA PERAMOENA	PURPLE FRINGELESS ORCHID		E		G5	S1
POLYGALA POLYGAMA	RACEMED MILKWORT				G5	S2
POLYGONUM GLAUCUM	SEA-BEACH KNOTWEED		E		G3	S1
PUCCINELLIA FASCICULATA	SALTMARSH ALKALI GRASS				G3G5	S2
PYCNANTHEMUM TORREI	TORREY'S MOUNTAIN-MINT		E		G2	S1
RANUNCULUS PUSILLUS VAR PUSILLUS	LOW SPEARWORT				G5T4?	S2
RHODODENDRON CANADENSE	RHODORA		E		G5	S1

MIDDLESEX COUNTY

RARE SPECIES AND NATURAL COMMUNITIES PRESENTLY RECORDED IN
THE NEW JERSEY NATURAL HERITAGE DATABASE

NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS	REGIONAL STATUS	GRANK	SRANK
RIBES CYNOSBATI	PRICKLY GOOSEBERRY				G5	SH
SAGITTARIA AUSTRALIS	SOUTHERN ARROWHEAD		E		G5	S1
SAGITTARIA CALYCINA VAR SPONGIOSA	TIDAL ARROWHEAD				G5T4	S3
SCIRPUS MARITIMUS	SALTMARSH BULRUSH		E		G5	SH
SCUTELLARIA LEONARDII	SMALL SKULLCAP		E		G4T4	S1
SOLIDAGO ELLIOTTII	ELLIOTT'S GOLDENROD				G5	S3
SOLIDAGO RIGIDA	PRAIRIE GOLDENROD		E		G5T5	S1
STACHYS HYSSOPIFOLIA	HYSSOP HEDGE-NETTLE				G5	S2
TRIGLOCHIN MARITIMA	SEASIDE ARROW-GRASS		E		G5	S1
UTRICULARIA GIBBA	HUMPED BLADDERWORT			LP	G5	S3
UTRICULARIA PURPUREA	PURPLE BLADDERWORT			LP	G5	S3
VERBENA SIMPLEX	NARROW-LEAF VERVAIN		E		G5	S1
VICIA AMERICANA VAR AMERICANA	AMERICAN PURPLE VETCH				G5T5	S2
VIOLA BRITTONIANA VAR BRITTONIANA	BRITTON'S COAST VIOLET				G4G5T4T5	S3
ZIGADENUS LEIMANTHOIDES	DEATH-CAMUS		E		G4Q	S1

94 Records Processed

APPENDIX C

Longitudinal Peaked Stone Toe Protection
(Derrick, pers. comm., 2004)

LONGITUDINAL PEAKED STONE TOE PROTECTION (LPSTP)

DRAFT DRAFT 6/2/2000

Description - LPSTP, is a continuous stone dike placed longitudinally at, or slightly streamward of, the toe of the eroding bank. The cross-section is triangular in shape. The LPSTP does not necessarily follow the bank toe exactly, but can be placed to form an improved or "smoothed" alignment through the bend. The LPSTP must be keyed into the bank at the upstream and downstream ends and at regular intervals along its entire length.

Tie-backs are short dikes connecting the LPSTP to the bank at regular intervals. They are only used in areas where the LPSTP does not follow the toe of the bank. All tie-backs are keyed into the bank. If tie-backs are long they should be angled upstream (to act as Bendway Weirs and direct currents away from the eroding outer bank). Tie-backs are usually constructed to the same height as the LPSTP, or sloped slightly higher toward the bank end.

How this method works - This continuous bank protection technique resists the erosive flow of the stream, thereby stabilizing the toe of the bank. The "smoothed" longitudinal alignment results in improved stream flow near the toe of the eroding bank. Success of this method depends on the ability of stone to self adjust, or "launch", into the scour hole formed on the stream side of the LPSTP. The stone must be well graded so as to launch properly. The weight of the stone (loading of toe) also resists geotechnical bank failure and mass wasting. The LPSTP captures alluvium and upslope failed material (colluvium) on the bank side of the structure, thus providing a foundation for vegetation to become established. If the mid-to upper bank is left untreated these areas will fail to a stable slope (at the angle of repose of the bank material), and usually within a short period of time will be invaded and naturally revegetated by native plants. Over time this vegetation strengthens and further stabilizes the project.

Level of Confidence in stand alone configuration - MEDIUM

Level of Confidence in combination with other methods - MEDIUM TO HIGH

Ability to blend with other methods - MEDIUM TO HIGH

Ability to adjust to scour - HIGH

Applicability - Well suited for many situations where a continuous bank protection method is needed, and particularly applicable for ephemeral, narrow, and small to medium sized streams. LPSTP is also well suited for areas where the toe is suffering erosion but the mid and upper bank areas are fairly stable due to cohesive materials, vegetation, infrequent short duration inundation, or relatively slow flow velocities.

LPSTP can be applied in some situations where the bankline needs to be built back out into the stream, where the existing stream channel needs to be completely realigned, where flow force needs to be redirected (bridge or pipeline protection, etc.), where the outer bank alignment makes abrupt changes (scallops, coves, or elbows), or where the stream is not smoothly aligned. However, in the aforementioned situations the crest should be constructed to a high enough elevation so that it is not overtopped frequently.

Advantages - Bank grading, reshaping, or sloping is usually not needed (existing bank and overbank vegetation is not disturbed or cleared), and a filter cloth or gravel filter layer is usually not needed. LPSTP works well in zoned and blended configurations (with bank paving or bio-engineering in mid to upper bank areas, or Bendway Weirs streamward of the LPSTP). In some instances the LPSTP itself has been invaded by herbaceous plants and sycamore trees, resulting in a more aesthetically pleasing (barely visible) project. LPSTP is relatively simple to design and specify and is a thoroughly tested method that has been used in a wide variety situations and has been monitored extensively.

Disadvantages - By definition LPSTP only provides toe protection and does not protect mid- and upper bank areas. Some erosion of these areas should be anticipated during long-duration, high energy flows, especially before these areas stabilize and become vegetated.

In areas of deep scour LPSTP might not provide sufficient rock to launch into the scour hole. If excessive scour occurs, the overlaunching of rock will result in a lowering of the crest elevation of the LPSTP. If excessive scour is anticipated, a Longitudinal Fill Stone Toe Protection (LFSTP), instead of LPSTP, should be applied.

Design considerations - The LPSTP should be designed to provide as smooth of an outer bank alignment as possible. The amount of stone required depends on a number of factors, including stream and flow alignment into the project reach, depth of scour at the toe, height of bank in relation to stage duration, and estimated stream forces (impinging flow) on the outer bank. Stone for LPSTP should be well graded and properly sized.

LPSTP can be specified either by weight or volume, or to a specific crest elevation. Typically LPSTP applied at the rate of 1 ton of stone per lineal ft of protected bank will have a height of approximately 3-ft (measured from the bed of the stream where the stone was placed). Two tons per ft of LPSTP is 5 to 5.5 ft tall, whereas 0.5 tons per ft is approximately 2-ft tall.

In areas where the bed of the stream is uneven, or deep scour holes are evident, the crest of the LPSTP should be constructed to a specified elevation. This elevation can be referenced to an established datum, or specified as a certain height above the base flow or typical low-flow water surface elevation.

LPSTP might not launch effectively in areas where the bank

is composed of layers of cohesive and non-cohesive materials, in which case the LPSTP could become "perched" on a cohesive layer.

In a situation where clay outcrops or sections of the bank are cohesive and other areas are composed of non-cohesive materials the differential erosion rates could result in discontinuities (scour and eddies) between launched sections of LPSTP and the erosive resistant in-situ materials.

There is little guidance available to determine to what height the crest of the LPSTP should be constructed to. Experience on the Mississippi River has shown that stone protection works built to an elevation overtopped by river flow 15 percent of the time or less have been successful. On the Red River 10 percent or less of structure inundation has been effective, and on deeply incised small to medium-sized streams in north Mississippi overtopping 3 to 4 percent of the time has worked well. However, translating these percentages to a specific watershed is probably risky and problematic.

For any application the LPSTP must be keyed deeply into the bank at both the upstream and downstream ends and at regular intervals along its entire length. On small streams 75-100 ft spacing between keys is typical, while on larger streams and smaller rivers one to two multiples of the channel width can be used as a spacing guide. If tie-backs are required, the same spacing guidelines developed for keys can be used. The minimum key recommendation for small to medium sized streams is a Type C key (excavated into the bank and backfilled with stone) constructed to a height equal to top bank elevation or the Q-2 water surface elevation (whichever height is less). On larger streams and smaller rivers with banks less than 25 ft tall Type D keys are recommended. Type D keys are excavated from the LPSTP to top bank with an excavated section (called a bankhead or root) going into the bank. A rule-of-thumb to determine the length of the bankhead section of the Type D key would be to add the maximum height of the outer bank of the bend to the maximum scour depth. On larger streams and smaller rivers with banks greater than 25 ft tall an analysis of the Q-2, Q-5, and Q-10 water surface elevations should be performed. After analyzing this information an informed choice between a Type D or Type C key can be made, and if the Type C key is chosen, to what height the key should be constructed to.

Where public or private works (roads, buildings, powerlines etc.) are in close proximity to the eroding bank some type of mid and upper bank protection and/or Bendway Weir system should be combined with the LPSTP.

Combining Longitudinal Peaked Stone Toe Protection (LPSTP) with Willow Posts - Typically 1 to 3 rows of willows are planted on the bank side of the crest of the LPSTP. The willows must be planted landward of, and at a higher elevation than, the crest elevation of the LPSTP, otherwise standing water or water trapped landward of the LPSTP may drown the willows. The row nearest the stream should be planted just landward of the LPSTP. The maximum stone height of the LPSTP must be low enough so that rows of posts further up bank are still able to penetrate the water

table. Spacing between rows might have to be adjusted to obtain this.

Combining Longitudinal Peaked Stone Toe Protection (LPSTP) with Willow Curtains and/or Willow Poles - These proposed combinations have never been tried. If the LPSTP crest is relatively low, and the moisture needs of the willows are met, then these combinations should have a high probability of success.

Combining Longitudinal Peaked Stone Toe Protection (LPSTP) with Bendway Weirs - An excellent choice for areas where further erosion (movement) of the toe of the bank cannot be allowed. Also good for tight (small radius) and high degree of curvature (horseshoe type) bends. The LPSTP should be constructed to a height equal to, or higher than the crest of the Bendway Weirs. In many cases the weirs can be built very long and low and the factor controlling weir height might be the size of stone used.

Construction techniques - All LPSTP should be constructed in an upstream to downstream sequence. LPSTP generally requires heavy equipment for excavation of keys and efficient hauling and placement of the stone. LPSTP can be constructed from within the stream, from construction roads built along the lower section of the streambank itself, or from top bank. The preferred method is from the bar side of the stream, as this results in the least disturbance of existing bank vegetation. The least preferred method is from top bank since this typically disturbs or destroys the most bank vegetation and the machine operator's vision is limited (resulting in longer construction times). Usually the keyways are excavated first and the rock is dumped into the key. The rock is then formed into tie-backs (if needed) and finally the LPSTP is constructed along a "smoothed" alignment, preferably with a uniform radius of curvature throughout the bend if possible. In a multi-radius bend, smooth transitions between dissimilar radii are preferred.

Prior to construction, the alignment that the LPSTP is to be placed on should be marked, along with the locations of all tie-backs, keys, rock staging (short term storage) areas, and haul roads. The locations of the keys can usually be moved slightly upstream or downstream so as to avoid disturbing valuable bank vegetation. Design, bidding, and supervision of construction is relatively simple.

Environmental benefits - The stone the LPSTP is constructed from will increase available habitat in streams where rocky habitat is limited. Studies show that a well graded stone has many aquatic habitat benefits. Scour along the streamside toe of the LPSTP provides some aquatic habitat benefits (diversity of depth and hiding areas for juveniles in the interstices of the rock). The rock used for the LPSTP provides a stable substrate for benthic invertebrates. Volunteer vegetation usually becomes established on mid to upper bank areas (and in some instances grows through the LPSTP itself) which can improve terrestrial habitat and provide canopy cover and a supply of carbon based debris to the

stream.

Low-cost modifications that can enhance the environmental benefits of this method - Typically LPSTP by itself results in a relatively deep, narrow, and uniform triangular channel cross-section immediately adjacent to the streamside toe of the LPSTP. Flow characteristics are fast and relatively uniform in this channel. To add complexity and diversity of flow, velocity, depth short, perpendicular "stub" dikes (Shields and Cooper, 1997) can be attached at intervals on the stream side of the LPSTP. The stub dikes used by Shields were 10 ft long, as tall as the LPSTP, angled normal (90 degrees) to the LPSTP, and spaced on 50 ft intervals.

Low and long Bendway Weirs can also be added in a similar manner to improve the hydraulic performance of the project and provide complex flow, depth, and velocity diversity.

Time estimates - On one job in a small creek (average width equal to 50-ft, maximum water depths of 4-ft) with the stone delivered and staged on the pointbar, a contractor with two equipment operators placed 200 to 250 tons of stone in an eight hour day using one tracked backhoe and one front end loader. Type B keys were also excavated as needed during this workday. In this case stone had to be moved across the stream from the pointbar to form the LPSTP, not dumped down the keyways, which is quicker.

Cost estimates - Costs are dependant on cost of stone and amount of stone used. Counting keys and tie-backs, typically 120 to 140 tons of stone will be used for each 100 ft length of LPSTP when placed at a rate of 1 ton/per lineal ft of protected bank. In many parts of the country cost of stone delivered and placed in the stream ranges from $14.00 to $25.00 per ton, therefore costs for LPSTP placed at a rate of 1 ton/ft ranges from $16.00 to $35.00 per lineal ft of protected bank.

Maintenance and Monitoring - LPSTP is relatively easy to restore, repair, and maintain. As with all bank protection projects, periodic inspection and analysis is recommended. Scour near the LPSTP and keys, and on the bank immediately above the crest elevation of the LPSTP should receive particular attention. Also, cracking and weathering of stone due to differential weathering or repeated freeze-thaw cycles should be monitored.

Companion case history - None at this time.

References -

Shields, F. D. Jr and Cooper, C. M., "Stream Habitat Restoration Using Spurs Added to Stone Toe Protection", Proceedings of the conference Management of Landscapes Disturbed by Channel Incision, pages 667-672. The University of Mississippi Press, Oxford, MS. May 1997.

LONGITUDINAL FILL STONE TOE PROTECTION (LFSTP)

draft draft draft 4/27/98

Description -Longitudinal Fill Stone Toe Protection (LFSTP) is exactly the same as Longitudinal Peaked Stone Toe Protection (LPSTP), except that instead of coming to a peak, the crest has a specified width. Therefore, LFSTP has a trapezoidal cross-section as compared to the triangular cross-section of LPSTP. Since LFSTP and LPSTP are similar in many aspects (how the method works, applicability, construction techniques, environmental benefits, low-cost environmental enhancements, and maintenance and monitoring) please refer to the LPSTP write-up for more information. Listed below is information specific to LFSTP.

Advantages - Same as LPSTP. In addition, in areas of deep scour LFSTP provides sufficient rock to launch into the scour hole while still maintaining the crest height of the LFSTP.

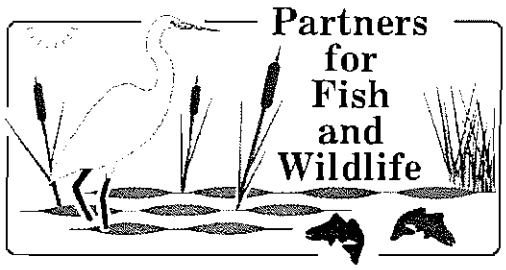
Design considerations - The maximum scour depth should be calculated. The volume of stone needed for launching into the computed scour hole (with an appropriate margin-of-safety incorporated into the design) should be calculated. Based on these volume of stone calculations the crest width can then be back-calculated.

Combining Longitudinal Fill Stone Toe Protection (LFSTP) with rip-rap or bank paving - This is an excellent combination for areas where both full bank protection is needed and the alignment of the bend needs to be improved. The bank can be cut or filled as needed and sloped to a stable grade (2H on 1V, or flatter). After installation of the LFSTP the Corp's Channelpro program can be used to design the bank paving.

This is also an excellent choice for areas where the bank needs to be built back out into the stream. After the installation of the LFSTP the area between the eroding bank and the LFSTP could be backfilled and revetment placed on the fill material. This will result in some savings as keys and tie-backs will not be needed in the backfilled areas. In some cases the backfilled areas can receive vegetative treatments instead of revetment.

APPENDIX D

U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program



U.S. Fish & Wildlife Service

Partners for Fish and Wildlife

Frequently Asked Questions

1. What is the Partners for Fish and Wildlife program?

The Partners for Fish and Wildlife program is a technical and financial assistance program administered by the U.S. Fish & Wildlife Service. It works in voluntary partnership with private landowners to restore wetlands, streams and river corridors, prairie, grasslands and other important fish and wildlife habitats for federal trust species (migratory birds, threatened and endangered species, anadromous fish, and some marine mammals). The Program provides advice on the design and location of potential restoration projects as well as financial assistance to implement the projects. Program staff also provide technical assistance to the U.S. Department of Agriculture on its conservation programs.

2. What are the goals of the Program?

The goals of the Partners for Fish and Wildlife program are to:
1. Implement pro-active, voluntary, on-the-ground habitat restoration projects that benefit federal trust fish and wildlife species on private and tribal lands.
2. Develop partnerships to implement these habitat restoration projects.
3. Demonstrate applied technology for habitat restoration projects to help the public understand and participate in fish and wildlife resource conservation.

3. Who can become a Partner?

Although our primary partners are private landowners, anyone interested in restoring and protecting wildlife habitat on private or tribal lands can get involved in the Partners for Fish and Wildlife program, including other federal, State and local agencies, private organizations, corporations, and educational institutions.

4. What kind of land is eligible for restoration under the program?

Any type of privately-owned degraded fish or wildlife habitat is potentially eligible for restoration under the Partners for Fish and Wildlife program.

5. How does the Service handle the financial assistance in the program?

In conjunction with its interested partners, the Service provides financial assistance to private landowners for a restoration project. The landowner may perform the restoration and be reimbursed directly for some or all of his or her expenses. Alternatively, the Service may hire a contractor to complete the work, or the Service may complete the work itself.

While not a program requirement, a dollar-for-dollar cost share is sought on a project-by-project basis. Partners for Fish and Wildlife funds are not used to purchase or lease real property interest or to make rental or other incentive payments to landowners.

6. Do I have to allow public access to my land?

No, having a Partners for Fish and Wildlife restoration project on your property does not mean that you have to open your land up to public access. Service employees, however, may occasionally need access to the project to check on its progress.

7. What is a landowner agreement?

Before implementing habitat projects, the Service and the landowner must sign an assistance agreement or similar document that protects the federal investment. The length of the agreement must be proportional to the technical and financial assistance provided by the Service, but in no case will the duration be less than 10 years. The agreement states that the landowner will not return the project to its former use or damage or destroy the project during the agreement period without reimbursing the Service for the funds spent on the project. Otherwise, the landowner still retains all legal rights to their property.

8. How can I become a partner?

You can become involved by contacting your State Partners for Fish and Wildlife Coordinator. If a project appears feasible, and fits within the program's priorities, the biologist will schedule a visit to your property. Please see our list of Partners Coordinators for the contact in your state.

9. When will the work be done?

The project will be done as soon as possible based on site selection priorities, available funds and site characteristics such as seasonal conditions. Your project may be done that field season, or you may be added to a list of waiting landowners. In some states, the Service has more landowners interested in the program than it has funds to complete the projects and thus there may be a waiting list.

10. Where does the program focus its efforts? What priorities drive the program?

The U.S. Fish and Wildlife Service focuses projects in ecosystems or watersheds where our efforts will accomplish the greatest benefits for federal trust species. Projects are designed so that they contribute to the objectives set for these areas. Highest priority is given to projects that benefit declining migratory bird and fish species,

species that are endangered, threatened or proposed for listing, and to projects on private lands that satisfy the needs of wildlife populations on National Wildlife Refuges or contribute to the resolution of problems on refuges.

The Service also gives special consideration to projects that:
1) are on permanently protected lands;
2) are identified as high priority by Service ecosystem teams or State fish and wildlife agencies and other partners;
3) reduce habitat fragmentation;
4) conserve or restore natural communities which the State Natural Heritage Programs or Heritage Data Base have designated as globally or nationally imperiled; or
5) result in self-sustaining systems that are not dependent on artificial structures.

If other considerations are roughly equal, priority is given to projects that:
1) have longer duration agreements;
2) involve greater non-Service partnerships and/or cost sharing; and
3) have the greatest cost-effectiveness.

11. How do I know if my land has suitable areas for habitat restoration?

Almost any land that has been subjected to intensive land use (cropping, haying, grazing, timber harvest, or mining) may have restoration potential. If you are unsure whether your land is restorable, contact your local Partners for Fish and Wildlife Coordinator for more information. He or she will be able to assess your goals, the land's restoration potential, and the best approach to meet your needs.

For freshwater wetland restoration, areas that have been ditched or drained are the most common and easiest sites to restore. Saltmarsh restorations are often done in areas where soil or other fill was placed in the wetland, where the marsh has been isolated from tidal influence, or where the marsh was ditched for mosquito control.

Riparian restoration is usually undertaken when stream and river banks have little or no vegetation and are eroding. Upland restoration (grasslands, prairies, forests and other habitats) are usually completed in places where the land has been disturbed and the native vegetation removed. A walk around the property with a Service biologist is the best way to find out about the restoration potential of the site.

12. How is the restoration done?

The project will be designed to restore the original look and function of the habitat. Eradicating any invasive species is also a restoration objective. Restoring freshwater wetlands can involve blocking drainage ditches, breaking tile drains, creating depressional areas, and recreating natural drainageways and stream meanders. Small berms or dikes may be constructed to block existing drainage systems, impound water, and create shallow water areas where plants can grow.

Riparian and in-stream restoration often involves removing the cattle from the stream, providing an alternate water source, and allowing nature to take its course. Sometimes native vegetation is planted to speed up the restoration process. In other cases, stream restoration requires innovative bioengineering techniques to re-create the shape and structure of the stream.

Upland restoration to native grass or woodland is usually accomplished through seeding, planting, or manipulation of existing vegetation through revised management practices (burning, cutting, grazing). Habitat restoration for specific fish and wildlife species, such as endangered species, can take many forms depending on the habitat needs of the wildlife. At many sites, several methods of restoration are done together. Native vegetation is always a priority for restoration.

13. What kind of maintenance is required?

Most wetland restorations are designed to require very little or no maintenance. Keeping livestock off dikes and maintaining water control structures are usually all that is required. This minor maintenance is generally the responsibility of the landowner.

Major maintenance requirements, such as repairing dikes or replacing water control structures, are reviewed on a case by case basis. Structural repairs that are required within the first year or two after construction as a result of improper design or construction techniques will be repaired by the Service. Normal long-term maintenance and repair of these structures is generally the responsibility of the landowner.

14. Will the Service help me build a stock pond on my property?

The Service does not provide funding for stock pond construction under the Partners for Fish and Wildlife program. We can, however, provide technical assistance that can help improve your existing pond for wildlife use. Generally, the primary goal of pond construction, whether by excavation or impoundment, is to maximize the amount of open water while minimizing the growth of cattails and other aquatic plants. These ponds provide limited value for wetland wildlife.

The goal of most wetland restoration projects is to create a diversity of habitat through a mixture of open water, emergent plants, shallow channels, and islands. Deeper water areas are usually a component of these systems, but average water depth for the entire project is less than 18 inches and these wetlands are sometimes only flooded on a seasonal basis. These conditions provide greater value to a diverse group of wildlife from waterfowl and shorebirds to amphibians and invertebrates.

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Pleasantville, New Jersey 08232
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August 2003

APPENDIX E

Coordination with the New Jersey Division of Fish and Wildlife

United States Department of the Interior

FISH AND WILDLIFE SERVICE

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Ecological Services
927 North Main Street, Building D
Pleasantville, New Jersey 08232
Tel: 609/646 9310
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In Reply Refer to:

FP-04/26

JUN 1 0 2004

Martin McHugh, Director
New Jersey Division of Fish and Wildlife
P.O. Box 400
Trenton, New Jersey 08625

Dear Mr. McHugh:

Enclosed is the U.S. Fish and Wildlife Service's (Service) Draft Fish and Wildlife Coordination Act Report for the U.S. Army Corps of Engineers, New York District's (Corps) proposed South Branch of the Rahway River Emergency Streambank Stabilization Project, Woodbridge, Middlesex County, New Jersey. This constitutes the Service's draft report on impacts on fish and wildlife (both beneficial and adverse) that can be expected to result from the Corps proposed plan. This report has been prepared pursuant to Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401; 16 U.S.C. 661 *et seq.*).

The Service's report contains an assessment of the proposed plan and recommendations for fish and wildlife resources. Please provide a letter of comment including indication of concurrence, or lack thereof, within 30 days from the date of this letter. If there are any questions concerning this report, please contact John Staples or Wendy Walsh of my staff at (609) 646-9310, extensions 18 and 48, respectively. Thank you for your assistance in this matter.

Sincerely,

Clifford G. Day
Supervisor

Enclosure

APPENDIX B: SECTION 404(B)(1) EVALUATION

Section 404(b)(1)
South Branch of the Rahway River, Woodbridge, New Jersey Section 14
Section 404 (b)(1) Evaluation

I. PROJECT DESCRIPTION

a. Location: Town of Woodbridge, Middlesex County, New Jersey.

b. General Description: Creation of a vegetated gabion wall along approximately 1,625 feet of the existing eroding streambank from milepost 130.5 to 132.2 of the Garden State Parkway. Small areas of riprap and or concrete headwall will be created surrounding existing pipe outfalls.

c. Authority and Purpose: The study has been authorized under Section 14 of the Flood Control Act of 1946 as amended, to study and construct emergency protection measures for public works and non-profit public services. The purpose of the project is to provide streambank stabilization and long-term protection to the Garden State Parkway, a major thoroughfare in the State of New Jersey, and to smaller state and local roads as well as the Menlo Park Terrace School property.

d. General Description of Fill Material

1.) Characteristics of Material: Material to be used to create and stabilize the slope are stone, wire baskets, concrete, and planting materials, including willows and dogwoods.

2.) Quantity of Material: Approximately 130 cubic yards of stone for riprap (approximately 85 linear feet of the bank), 80 bags of concrete (for spot repairs of existing bag wall and outfalls), 2,400 square feet of live stake stabilization(approximately 180 linear feet of the bank), 12,000 square feet of vegetated gabion basket stabilization (approximately 1,360 linear feet of the bank).

3.) Source of Material: The rock will be obtained from a local quarry. The planting materials will be bought from a local nursery.

e. Description of the Proposed Discharge Sites

1.) Location: The discharge site is located along the South Branch of the Rahway River and its unnamed tributaries.

2.) Size: Approximately 1625 ft of streambank will be stabilized.

3.) Type of Site: The project area is urbanized in nature bounded by single family homes, multiple family homes, Beth Israel Cemetery, small undeveloped areas along the roadway, and commercial parks.

4.) Types of Habitat: Although the upper portion of the slope is vegetated, the habitat value is minimal due to the extensive erosion causing collapse or exposure of the root system. The presence of introduced invasive species further limits the habitat value. The aquatic habitat consists of nontidal freshwater classified as as FW2-NT (general fresh surface water, non-trout) by NJDEP.

5.) Time and Duration of Disposal: Construction is expected to begin in November 2006 and is expected to last approximately 9 months.

II. FACTUAL DETERMINATION

a. Physical Substrate Determinations

1) Substrate Evaluation and Slope: Soils in the project area include the Boonton, Bucks, Rowland, and Haledon Series. Existing slopes in the areas to be stabilized range from from 1V:1H to 3V to 1H.

2) Material Movement: Placement of the stabilization structures will result in some increase in turbidity in the immediate area. Due to the relatively small size of the project, the turbidity is not expected to exceed conditions observed following heavy rainstorms. Turbidity increases will be of a temporary nature, highly localized, and will rapidly dissipate.

3) Physical Effects on Stream Bottom: The stream will be used as access for some of the construction work. This along with increased turbidity could bury or crush organisms on the streambed. As the project reaches are relatively small in comparison to the stream system, this impact is expected to be small and recolonization of the streambed by benthic organisms is expected soon after construction.

4) Other Effects: Due to the small size of the project, no unique or other effects are anticipated from this project.

5) Actions Taken to Minimize Impacts: Best management practices; including but not limited to silt fencing, turbidity curtains, coffer dams, and straw bales; will be utilized during construction and daily work will be limited to that which can be completed and stabilized in one day.

b. Water Circulation, Fluctuation and Salinity Determinations

1) Water, Consider Effects on:

a) Salinity- No effect

b) Water Chemistry- No effect

c) Clarity- Water clarity may be slightly impacted during construction activities but will be minimized through the use of best management practices

such as turbidity curtains. Overall water quality is expected to improve (particularly after storm events) with the bank stabilization work.

d) Color- No effect
e) Odor- No effect
f) Taste – No effect
g) Dissolved Gas Levels- No effect
h) Nutrients- No effects
i) Eutrophication- No effect
j) Others as appropriate- None anticipated.

2) Current Patterns and Circulation:

a) Current Patterns and Flow- The project may have a slight effect on current flow within the immediate project area vicinity, but is not expected to have any substantial impact on current patterns or flow throughout the stream.
b) Velocity- The project is not expected to significantly change the velocity of the stream. The vegetated gabions will create a rough surface that could slow flows during storm events, which may help to reduce the storm water velocities.
c) Stratification- The project will not impact stratification.
d) Hydrologic Regime- No effect.

3) Normal Water Level Fluctuations: The project will not cause any change in normal water levels within the stream system in general or on the site in particular.

4) Salinity Gradients: The water is fresh and the project is not expected to impact the salinity gradients.

5) Actions Taken to Minimize Impacts: Best management practices; including but not limited to silt fencing, turbidity curtains, coffer dams, and straw bales; will be utilized during construction and daily work will be limited to that which can be completed and stabilized in one day. In addition, the ends of the gabions will be tapered and tied in to the adjacent banks in order to provide a smooth transition into the existing streambank.

c. Suspended Particulate/Turbidity Determinations.

1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Sites: Disposal of any materials removed from the site will be to a local upland disposal site. The long-term benefits of bank stabilization will be to reduce the particulate matter inputs currently associated with the erosion.

2) Effects on Chemical/Physical Properties of the Water Column:

a) Light Penetration- No significant reduction in light penetration will be observable outside of the general vicinity of the project site. Any localized

reductions will fall within the range of conditions that normally occur following heavy precipitation.
b) Dissolved Oxygen- The project is not anticipated to have any significant impact on the basic chemical, dissolved oxygen, and nutrient attributes of the South Branch of the Rahway River. This assessment is based on the size of the project in relation to the size of the River, and the absence of any discharges of dissolved nutrients or oxygen demanding wastes.
c) Toxic Metals and Organics- The proposed construction will not have any impact on levels of trace metals or organic contaminants. There is no history of metal or organic contamination of the soils at the site. The silt that will be suspended during construction activities is also likely to be similar to what is resuspended by turbulence associated with storms.
d) Pathogens- The project will not cause any change in pathogen levels as no sewage or animal waste use or treatment is involved.
e) Aesthetics- The aesthetics of the project area have already been somewhat degraded due to the eroding bank. The proposed project will prevent further impairment of the bank through the installation of new stabilization features. The addition of vegetation to the gabion baskets is expected to improve the aesthetics of the structure and provide a more natural appearance.
f) Others as appropriate- Not applicable.

3) Effects on Biota:
a) Primary Production, Photosynthesis- No impact expected.
b) Suspension/ Filter Feeders- No impact expected.
c) Sight Feeders- No impact expected.

4) Actions Taken to Minimize Impacts: Best management practices; including but not limited to silt fencing, turbidity curtains, coffer dams, and straw bales; will be utilized during construction and daily work will be limited to that which can be completed and stabilized in one day.

d. Contaminant Determinations: All fill (rock) material will be clean and will not pose a risk. No hazardous or toxic waste is known to be present on the site.

e. Aquatic Ecosystem and Organism Determinations.
1) Effects on Plankton: No significant effects.
2) Effects on Benthos: Change or loss of substrate are expected to be temporary and localized. Recolonization of the area is anticipated after project construction.
3) Effects on Nekton: The project is unlikely to have any significant, widespread, or long lasting effects on these highly mobile organisms. Due to their mobility these organisms will avoid the site during construction but are expected to return soon after construction is completed.
4) Effects on Aquatic Food Web: Given the relatively small size and short duration of the disturbances associated with the project within the overall context of the size of the South Branch, significant impacts on the food web are not expected.

5) Effects on Special Aquatic Sites:
a) Sanctuaries and Refuges- Non applicable
b) Wetlands- Wetlands do exist on the opposite banks from the construction areas. No impact is expected as these areas will not be used for access or staging and no construction will occur within a wetland.
c) Mudflats- Non-Applicable
d) Vegetated Shallows- Not applicable
e) Coral Reefs- Non-Applicable
f) Riffle and Pool Complexes- No effect

6) Threatened and Endangered Species: No regulated species are known to occur in the project area.

7) Other Wildlife: The project will not have any significant long-term impacts on the waterfowl, upland birds or mammals in the project area. Due to their mobility, these organisms will avoid the site if conditions are temporarily unsuitable. Burrowing mammals and birds will not be able to utilize the stabilized banks, but would be expected to find suitable habitat nearby.

8) Actions to Minimize Impacts: Best management practices; including but not limited to silt fencing, turbidity curtains, coffer dams, and straw bales; will be utilized during construction and daily work will be limited to that which can be completed and stabilized in one day. Loss of trees will be minimized to the extent possible and any removed will be replaced with similar species after construction.

f. Proposed Disposal Site Determinations

1) Mixing Zone: Not applicable

2) Determination of Compliance with Applicable Water Quality Standards: Stone fill will be clean construction material and will meet water quality standards.

3) Potential Effects on Human Use Characteristic:

a. Municipal and Private Water Supply- Construction activities are not expected to impact the municipal water supply.

b. Recreational and Commercial Fisheries- The project is not expected to have any impacts to recreational or commercial fisheries.

c. Water Related Recreation- The shoreline currently offers no benefits for recreational uses, therefore no permanent or temporary adverse impacts are expected as a result of project implementation.

d. Aesthetics- The aesthetics of the project area have already been somewhat degraded due to the eroding streambank. The proposed project will prevent further impairment of the shoreline through the installation of stabilization features. Additionally, vegetation will be planted along the slope and at the top of the bank to soften the visual impact of the structure.

e. Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves- Not Applicable

g. Determination of Cumulative Effects on the Aquatic Ecosystem-
No cumulative effects from this project are expected on the aquatic ecosystem.

h. Determination of Secondary Effects on the Aquatic Ecosystem-
No secondary effects on the aquatic ecosystem are expected from this project.

III. FINDINGS OF COMPLIANCE OR NON-COMPLIANCE WITH THE RESTRICTIONS ON DISCHARGE.

a. No significant adaptation of the Section 404(b)(1) guidelines was made relative to this evaluation.
b. The objective of protecting The Garden State Parkway, Route 1, Gills Lane, and the Menlo Park Terrace School property necessitates stabilizing the streambank. The velocity of the stream and the height and slopes of the banks requires gabion baskets which can be vegetated to lessen the environmental impact of the hard structure.
c. The proposed activity will not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.
d. The proposed operations will not harm any endangered species or its critical habitat under the Endangered Species Act of 1973 or Essential Fish Habitat under the Magnuson Stevens Fisheries Conservation and Management Act.
e. The proposed project will not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic life and other wildlife will not be significantly affected. No adverse effects on aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic and economic values are anticipated.
f. Appropriate steps to minimize potential adverse impacts of the discharge of soil material include the implementation of an erosion and sediment control plan and judicious engineering practices.

APPENDIX C: RECORD OF NON-APPLICABILITY

DRAFT GENERAL CONFORMITY - RECORD OF NON-APPLICABILITY

Project/Action Name: South Branch of the Rahway River, Section 14, Emergency Streambank Protection

Project/Action Identification Number: N/A

Project/Action Point of Contact: Bobbi Jo McClain, Project Biologist, (917) 790-8718

Estimated Begin Date: September 2005

Estimated End Date: April 2006

General Conformity under the Clean Air Act, Section 176 has been evaluated for the project described above according to the requirements of 40 CFR 93, Subpart B. The requirements of this rule are not applicable to this project/action because:

__X__ Total direct and indirect emission of from this project/action have been estimated far below the conformity threshold value established at 40 CFR 93.153(b).

AND

The project/action is not considered regionally significant under 40 CFR 93.153(i).

Supporting documentation and emissions estimates are

(X) ATTACHED

( ) APPEAR IN THE NEPA DOCUMENTATION (*PROVIDE REFERENCE*)

( ) OTHER _____.

SIGNED Frank Santomauro.

(*Frank Santomauro, Chief, Planning Division*)

U.S. Army Corps of Engineers
South Branch of the Rahway River
General Conformity Review and Emissions Inventory

The study area is located in the Town of Woodbridge, Middlesex County, NJ along the South Branch of the Rahway River and its tributaries from milepost 130.5 to 132.2 of the Garden State Parkway (Parkway). The proposed project will include the installation of vegetated gabions along approximately 3,050 linear feet of stream.

The primary sources of air emissions are the compression ignition diesel engines associated with the non-road construction equipment (cranes, backhoe's etc.). Trigger levels for conformity are 25 tons/year for NOx, 25 tons/year for VOC, and 100 tons/year for CO.

The analysis for this project focused on NOx emissions, as this typically has the highest emission values in terms of mass. Table 1 shows the rough estimates for the equipment anticipated for this project. As estimated, the total NOx emissions for this project is 1.43 tons/year.

Table 1: Individual Equipment Emissions

Equipment	Hours	Horse-power	Load Factor	NOx EF (g/hp-hr)	NOx tons
Backhoe	1376	99	21%	6.9	0.22
Dump Truck	536	518	59%	5.0	0.90
Truck Crane (Gradall)	80	300	59%	5.0	0.08
Flat Bed Truck	80	300	59%	5.0	0.08
Crane	40	350	43%	7.6	0.05

Equipment	Hours	Avg Speed	NOx EF (g/mile)	NOx tons
Pickup Truck	1600	45	1.25	0.099

Total: 1.43 tons/year

Non-road equipment emissions were estimated using the EPA NONROAD Model (USEPA June 2000) with the assumption that the equipment engines would meet the existing Tier I standard. Prior to 1996, non-road diesel engines were unregulated. After this time, Tier I standards became effective in limiting NOx emissions. A more stringent set of emissions standards, Tier II, became effective by 2004. The USEPA is currently re-evaluating Tier III standards that may come into effect in the 2007-2010 timeframe. This estimate uses Tier I to be conservative as some equipment may be newer models and may meet higher standards.

Non-road emissions were estimated using the following general equation:

Emissions (tons) = Horsepower x Active Time (hours) x LF x EF (tons/hp-hr)

Where,

LF = Load Factor (average percent of horsepower used)
EF = Emissions Factor (g/hp-hr, converted to tons/hp-hr)

On road vehicles, such as the pick up trucks, utilize a slightly different equation:

Emissions (tons) = Active Time (hours) x Average Speed (miles/hr) x EF (tons/mile)

Where,

EF = Emissions Factor (g/mile, converted to tons/mile)

On road vehicle standards are available from the EPA in their MOBILE model (USEPA 2005). Again, conservative estimates were made by assuming a diesel vehicle at the Tier I standards.

It is typical for NOx emissions associated with diesel compression-ignition engines to have the highest values in terms of mass. Typically the second highest emissions amount for projects is CO, which has a trigger level of 100 tons/year. As this project emits only 1.43 tons as a conservative estimate, which is far below the trigger levels, further analysis was deemed unnecessary.

References:

U.S. Environmental Protection Agency (USEPA). April 2005 (online). Draft NONROAD Model. June 2000. Available online at: http://www.epa.gov/otaq/nonrdmdl.htm.

U.S. Environmental Protection Agency (USEPA). April 2005 (online). MOBILE Model. Available online at: http://www.epa.gov/otaq/mobile.htm